Special Publication SJ2000-SP8

REVIEW OF INTEGRATED SURFACE WATER/GROUND WATER COMPUTER MODELS

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Prepared for the St. Johns River Water Management District

July 18, 2000

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Table of Contents

1 Executive Summary

This document is organized into several parts, as follows: A brief introduction with a basic categorization of hydrologic processes and interactions is provided in Section 2. Section 3 discusses the primary surface and subsurface hydrologic processes that should be included in a comprehensive model of ground water/surface water interactions. Each of these processes is discussed in turn, and governing equations are presented. Following this, Section 4 discusses the interactions between the various hydrologic processes discussed in Section 3. Section 5 discusses existing ground water and surface water models that have been utilized in integrated ground water/surface water models. The integrated models are discussed as well. Some conclusions regarding the integrated models and how they are implemented are discussed in Section 6. Specific recommendations regarding the objectives, implementation details, and applications of integrated surface water/ground water models are given in Section 7. Section 8 focuses on how an integrated ground water/surface water model should be applied to Tiger Bay Canal watershed and Bennett Swamp in Volusia County, Florida.

The first step in the development and implementation of an integrated surface water/ground water model requires identification of the active hydrologic processes and interactions between processes in the geographic area being modeled. As part of this identification procedure, it is helpful to first partition the hydrologic domain according to how water is stored (i.e., in the surface or subsurface) and then determine an appropriate model for simulating the processes within each storage domain. Interactions between surface water and ground water processes can then be modeled as transport processes between different storage domains. Processes occurring

entirely within a given storage domain are referred to as either *intra-storage processes* or just *hydrologic processes*. Processes that include transfer of water between storage domains are referred to as *inter-storage processes* or *hydrologic interactions*.

The primary intra-storage hydrologic processes discussed in Section 3 are

- Channel flow
- Overland flow.
- Saturated ground water flow
- Partially saturated ground water flow

A brief description of each process is provided, together with the basic governing equations.

The hydrologic interactions discussed in Section 4 are:

- Infiltration.
- Leakage (or leakance).
- Recharge.
- Capillary rise.
- Evapotranspiration.
- Throughfall.

For the purposes of this report, processes within the atmosphere are not covered and the atmosphere is treated either as a source (of precipitation) or sink (for evapotranspiration).

Section 5 discusses a number of existing integrated surface water/ground water models. In most of the cases reviewed, these models are based on existing surface water or ground water models

that have added functionality to represent interactions between surface water and ground water. Most of these models fall into two categories, depending on how they add the new functionality. This first type links two or more existing hydrologic models together in some fashion, while the second adds functionality to existing computer models with new modules or packages to simulate the desired interactions. In Section 5.1 some of these existing models are described as background for discussion of integrated models, including MODFLOW, AQUIFEM-N, SWAT, HSPF, and SWMM.

Coupled surface water/ground water models are examined in Section 5.2. This discussion covers models that simulate interactions between a limited number of processes, such a river/aquifer or lake/aquifer interactions, as well as models that attempt to couple many different hydrologic processes on regional scales.

2 Introduction

Physical hydrology deals with the movement of water between several different physical domains. For our purposes, we can divide the physical domains into three main categories of storage: atmosphere, land surface, and sub-surface. Each of these three categories can be subdivided further depending on the domains that the modeler determines is important. For example, land surface storage can be further subdivided into storage in vegetation, water bodies, and surface detention, and water bodies can be further subdivided into storage in lakes and rivers/streams. Sub-surface storage can be divided into storage in the vadose zone (partially saturated zone) and the saturated zone.

Critical to developing and/or implementing a model is determining which processes are to be modeled. If the physical hydrologic domain is divided into the storage categories outlined

above, the processes describing water transport can be divided into two general categories: those processes that describe transport of water entirely within a single storage domain, and those that describe transfer of water between two or more different storage domains. The first set of processes will be referred to as either *intra-storage processes* or just *hydrologic processes*, while the second will be referred to as *inter-storage processes* or *hydrologic interactions*.

The main intra-storage processes that are included in the majority of hydrologic models include

- Saturated ground water flow
- Partially saturated ground water flow
- Channel flow
- Overland flow.

Models of these processes have been developed over several decades, and most of the advantages and/or pitfalls of various modeling approaches and classes of models are well understood. In contrast, implementation of the various hydrologic interactions in models has not received as much study, although the actual inter-storage hydrologic processes are naturally quite well known. Traditionally, these interactions are implemented as boundary conditions for a particular intra-storage process, for example a leakage term as a boundary condition on a saturated ground water flow model.

The dominant storage zones and inter-storage transfer processes that are recognized in hydrologic models are shown graphically in Figure 1. They include

Precipitation. This is the mechanism by which water is transferred from the atmosphere to the land surface by rainfall, snowfall, etc.

Infiltration. This is the movement of water from the surface into the underlying soil matrix (vadose zone).

Overland flow. This is the movement of water over the land surface, and can act to transfer water between surface detention (possibly temporary) and into channels and/or lakes, or into the subsurface. Note that overland flow can also be viewed as an intra-storage process.

Leakage (or leakance). This is a transfer of water between the saturated zone and water in river, channels, and/or lakes.

Recharge. This is the transfer of water from the partially saturated zone through the water table into the saturated zone. Also sometimes referred to as percolation.

Capillary rise. This is the upward movement of water from the saturated zone into the vadose zone due to capillary forces.

Evapotranspiration. This is the movement of water, as water vapor, into the atmosphere. It includes the combination of evaporation occurring from soil, land surface, open water bodies, and vegetation (as interception return) and transpiration, which is the process by which water vapor is discharged from plant stomata into the atmosphere.

Throughfall. This is precipitation that falls from vegetation to the land surface.

Snowmelt. This is the mechanism by which water is transferred to the land surface from snow.

For the purposes of this report, processes within the atmosphere are not covered and the atmosphere is treated either as a source (of precipitation) or sink (for evapotranspiration).

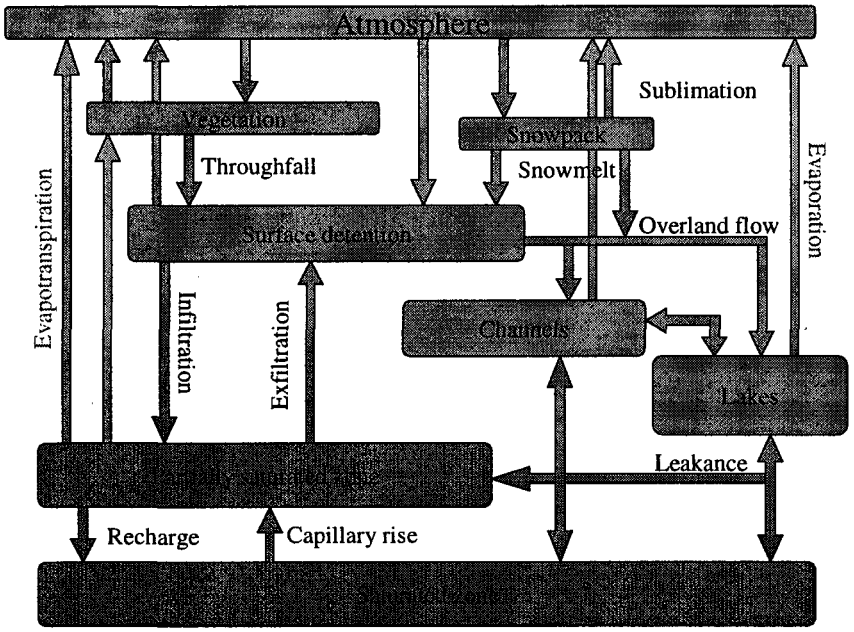

Figure 1. The primary storage zones and inter-storage transfer processes (hydrologic interactions).

3 Physical Hydrologic Processes

3.1 Channel/River Flow

This includes open channel and river flow. The complete one-dimensional equations of open-channel flow are given by the most general forms of the energy and continuity equations (see *Bras* [1990], *Dingman* [1994], and *Chow et al.* [1996]). These are also called the *Saint Venant Equations* and represent balance equations for energy (or momentum) and continuity, respectively:

$$\frac{dH}{ds} = \tan\beta_c - \frac{\partial Y}{\partial s} - \frac{U}{g}\frac{\partial U}{\partial s} - \frac{1}{g}\frac{\partial U}{\partial t}$$

$$q - U\frac{\partial A}{\partial s} - A\frac{\partial U}{\partial s} = \frac{\partial A}{\partial t}$$

In the above equations, H is the total energy, s is the downstream direction, dH/ds is the energy gradient (or energy slope, or friction slope) in the downstream direction, β_c is the local channel slope angle, U is the velocity, t is time, g is the acceleration due to gravity, Y is the average flow depth, q is the rate of lateral inflow per unit channel length and A is the cross-sectional area. A solution to the full Saint Venant equations will provide water depths and velocities at all points within the channel for all times. Since there is no known general analytical solution, numerical approximations must be used. In many circumstances, certain simplifications can be made.

If the slope of the channel bed is relatively small so that the acceleration terms in the above equations ($\partial U/\partial s$ and $\partial U/\partial t$) can be neglected and the width X is assumed constant (note $A = XY$) the above equations reduce to the *convection-diffusion equations* [*Dingman*, 1994]:

$$\frac{dH}{ds} = \tan\beta_c - \frac{\partial Y}{\partial s}$$
$$q - \frac{\partial Q}{\partial s} = X\frac{\partial Y}{\partial t} \qquad 1$$

Where the discharge $Q = UA$ has been written as $U\,\partial A/\partial s + A\,\partial U/\partial s = \partial Q/\partial s$. These equations can also be written in the combined form [*Dingman*, 1994]

$$\frac{q}{X} - \frac{3}{2}U_u\frac{\partial Y}{\partial s} + \frac{U_u Y}{2\tan\beta_c}\frac{\partial^2 Y}{\partial s^2} = \frac{\partial Y}{\partial t}$$

In these equations, U_u is the uniform flow velocity. If the pressure-force term $\partial Y/\partial s$ is also considered negligible in relation to the bottom slope, in addition to the other terms neglected above we have the *kinematic wave equations*:

$$\frac{dH}{ds} = \tan\beta_c - \frac{\partial Y}{\partial s}$$
$$q - \frac{\partial Q}{\partial s} = X\frac{\partial Y}{\partial t} \qquad 2$$

Which, written in the combined form is

$$\frac{q}{X} - \frac{3}{2}U_u\frac{\partial Y}{\partial s} = \frac{\partial Y}{\partial t}$$

In the case where the inertial terms and the pressure-force terms are negligible and the flow is turbulent, the equation of motion of the flow is given by the Chezy equation:

$$U = CR^{1/2}(\tan\beta_c)^{1/2} \qquad 3$$

or by Manning's equation:

$$U = \frac{1.486}{n} R^{3/2} (\tan \beta_c)^{1/2} \qquad 4$$

where C and n are friction constants (Chezy's constant and Manning's roughness factor, respectively), and R is the hydraulic radius.

3.2 Overland Flow

The equations describing overland flow have the same basis (the Saint-Venant Equations) as the equations described above for channel flow. However, the hydraulics of sheet flows can be strongly affected by the action of raindrops, which can create numerous turbulent eddies, even if the flow regime is laminar. Furthermore if the surface is highly irregular or vegetated, conditions can approach those of a porous medium.

As with channel flow, if an overland flow satisfies the criteria that the acceleration terms are negligible, it can be modeled with the convection-diffusion equations above [1]. If the pressure-force term in the Saint Venant equations is negligible in relation to the other terms, it can be modeled as a kinematic wave. In this case, for overland flow the generalized equation of motion:

$$U = aY^m \qquad 5$$

can be used. Here, a is a generalized resistance term and slope factor and the exponent m generally varies between 0 and 2. The Chezy equation [3] is written in this form with m = 1/2. Using equation [5], the overland flow discharge $q(s,t)$ per unit slope width at a given location s and time t can be written as

$$q(s,t) = Y(s,t)\left[aY(s,t)^m\right] = aY(s,t)^{m+1}$$

[*Dingman*, 1994]. Differentiating q with respect to s and substitution the result into the generalized equation of motion [5] gives the kinematic wave equation for overland flow

$$w_{\text{eff}} - (m+1)U(s,t)\frac{\partial Y(s,t)}{\partial s} = \frac{\partial Y(s,t)}{\partial t} \qquad 6$$

where w_{eff} is the effective water input rate (assumed constant).

3.3 Saturated Ground Water Flow

3.3.1 Confined Aquifer Flow

The dynamics of flow in saturated porous media is governed by Darcy's equation:

$$\mathbf{q} = -K \cdot \nabla h \qquad 7$$

where $\mathbf{q}$ is the water flux, K is the saturated hydraulic conductivity, and h is the piezometric head. The basic groundwater equations in saturated media are obtained by combining Darcy's equation with mass balance equations. This results in

$$\nabla \cdot \mathbf{q} = -S_s \frac{\partial h}{\partial t} - f \qquad 8$$

where S_s is the specific storativity and f is a source/sink term. Equation [7] can be substituted into equation [8] to obtain

$$\nabla \cdot [K \cdot \nabla h] = S_s \frac{\partial h}{\partial t} + f \qquad 9$$

3.3.2 Unconfined Aquifer Flow

The water table in an unconfined aquifer is a free surface, which complicates the groundwater flow problem. Equation [9] is valid, although its complete solution requires solution of a system with a variable boundary condition representing the phreatic surface. Typically, this problem is simplified by making certain simplifications (the Dupuit approximation) which lead to a vertical integration of the equations to arrive at a two-dimensional system.

The Dupuit approximation makes the assumption that the slope of the phreatic surface is small in comparison with the total depth, so vertical components of flow can be ignored. Thus, $q_z = 0$ and $\partial q_y/\partial z = \partial q_x/\partial z = 0$. Further, assuming that water is incompressible, the bottom is horizontal, the hydraulic conductivity is constant with depth, and that there are no internal sources or sinks leads to the equation

$$\nabla \cdot [(Kh) \cdot \nabla h] = S\frac{\partial h}{\partial t} - R \qquad 10$$

where S is the storativity of the aquifer and R is the recharge rate per unit area of the aquifer. For a steady-state system with a homogeneous isotropic porous medium

$$\nabla \cdot [h \nabla h] = -\frac{R}{K}$$

Using the chain rule, this can be rewritten in terms of h^2:

$$\frac{1}{2}\nabla^2 h^2 = -\frac{R}{K}$$

Alternatively, this system can be written by integrating equation [9] over the vertical direction from the base of the aquifer z_b to the water table to give an equation in terms of h and the transmissivity T:

$$\nabla \cdot [T \cdot \nabla h] = S\frac{\partial h}{\partial t} + f - R \qquad 11$$

Where T is the transmissivity which is defined as:

$$T = \int_{z_b}^{h} K(z)\,dz$$

3.4 Partially Saturated Ground Water Flow

Flow in the partially saturated or vadose zone is much more difficult to model than flow in saturated media due to the fact that the connectivity of the water phase between pores becomes irregular and discontinuous as the water saturation decreases. Capillary effects become very important in determining water distribution and flow. A number of different models exist for describing flow in the vadose zone, ranging from highly complex and nonlinear models to simple lumped schemes.

3.4.1 Richards Equation

Richards [1931] derived an equation for flow through a partially saturated porous medium. Darcy's equation for flow in unsaturated porous media can be written as

$$\mathbf{q} = -K_w(p)[\nabla p + \nabla z] \qquad 12$$

While the mass balance equation can be written

$$\frac{\partial \theta}{\partial t} = -\nabla \cdot \mathbf{q} \qquad 13$$

In these equations p is the water pressure (sometimes written as ψ_w), K_w is the relative hydraulic conductivity of the medium (a function of the water pressure), and θ is the volumetric water content, which also varies with water pressure. These equations assume that the movement of the air phase is instantaneous and thus $p_a = 0$ everywhere in the unsaturated zone. Combining these equations, we arrive at the mixed form of Richard's equation [*Celia et al.*, 1990]

$$\frac{\partial \theta(p)}{\partial t} = \nabla \cdot [K_w(p)(\nabla p + \nabla z)] \qquad 14$$

This is the so-called mixed form because it incorporates both water saturation and pressure (head) in the governing equation. Other forms of Richard's equation are the so-called head-based and saturation-based forms. The saturation or water-content based form is written

$$\frac{\partial \theta}{\partial t} = \nabla \cdot [D(\theta) \cdot \nabla \theta] + \frac{\partial K(\theta)}{\partial z} \qquad 15$$

where

$$D(\theta) = K(\theta)\frac{\partial p(\theta)}{\partial \theta} \qquad 16$$

This form of Richard's equation can only be used if all parts of the domain remain partially saturated, since if any part of the domain becomes fully saturated, the term $\partial p(\theta)/\partial \theta$ becomes zero there. While the pressure-based form is written

$$C(p)\frac{\partial p}{\partial t} = \nabla \cdot [K(p) \cdot \nabla p] + \frac{\partial K(p)}{\partial z} \qquad 17$$

where

$$C(p)=\frac{d\theta}{dp} \qquad 18$$

Solutions of Richard's equation can give highly accurate descriptions of water movement as well as distribution of water within the vadose zone. Unfortunately, it is computationally expensive to solve, since the relations between p, $K_w(p)$, and $\theta(p)$ are highly nonlinear and depend on the history of the soil with respect to wetting or drying. Empirical models describing the functional relationship between K_w and p, and θ and p, must be used, such as those developed by *Brooks and Corey* [1966] or *van Genuchten* [1980]. These relationships require detailed information about soil hydraulic properties that can be difficult to obtain.

4 Interactions

From a modeling sense, many of the interactions discussed below are most appropriately visualized as either coupled boundary conditions between the various intra-storage processes discussed above, or as coupled distributed source/sink terms within the governing equations.

4.1 Precipitation

In most "non-atmospheric" hydrologic models precipitation is treated as an independent boundary condition. This means that while it can be temporally and spatially variable over the domain, its magnitude and distribution does not depend on the internal state of the system but rather is an input variable. Therefore, it is reasonable to use either measured rainfall amounts when the simulation is event-driven, or synthetically generated rainfall amounts during calibration and testing or when testing a range of alternative scenarios.

4.2 Infiltration

Infiltration can be defined as the flux of water across the land surface into the soil. For our purposes, it will be defined as the coupling between surface storage and the vadose zone. The surface storage can either be temporary storage such as overland flow or ponded water, or permanent surface storage in lakes and rivers. Note that many of the models discussed in Section 6 treat flux from lakes or streams into the subsurface as leakage directly into the saturated zone and assume that there is no intervening partially saturated zone.

Infiltration can be incorporated as an event dependent boundary condition for the Richard's equations [15], however this involves significant computational expense. Some of the complexity

associated with using this method can be eliminated by using a one-dimensional form of Richard's equation:

$$\frac{\partial \theta}{\partial t} = \frac{\partial}{\partial z}\left[D(\theta)\frac{\partial \theta}{\partial z} \right] + \frac{\partial K(\theta)}{\partial z} \qquad 19$$

There are only a few specialized instances where an exact solution to Richard's equation can be found. For general cases, numerical solutions must be used. Such solutions to Richard's equation have the advantage that in addition to giving quite general time-variable infiltration rates, the moisture profile in the soil can be given accurately, given knowledge of soil hydraulic properties. In addition, it is possible to formulate fairly complex boundary conditions, such as switching from a flux-based (rainfall) form to a head-based (ponding) form if, for example, the rainfall rate exceeds the infiltration capacity and water ponds on the surface.

4.2.1 Philip Infiltration Equation

Philip's equation gives the approximate infiltration rate for a one-dimensional system with a saturated surface. This approach was developed by *Philip* [1957] as an approximate analytical series solution to the variable diffusivity problem together with gravity effects. The infiltration rate f_i is given by

$$f_i(t) \approx \frac{1}{2} S_i t^{-1/2} + A_i \qquad 20$$

where t is time and the parameters S_i (also called S, the sorptivity), and A_i are approximated by

$$S_i(t) = 2(\theta_0 - \theta_i)\left[\overline{D}/\pi\right]^{1/2}$$

$$A_i = \frac{1}{2}[K(\theta_0) - K(\theta_i)]$$

The parameter $\overline{D}$ is an effective value for the soil moisture diffusivity, θ_i and θ_0 are the initial and upper boundary (surface) conditions for θ, respectively, while $K(\theta_i)$ and $K(\theta_0)$ are the relative hydraulic conductivities at θ_i and θ_0. See *Bras* [1990] and *Dingman* [1994] for further details.

4.2.2 Horton Infiltration Equation

From equation [**Error! Reference source not found.**] an expression for the infiltration rate, assuming a constant soil moisture diffusivity, can be derived [*Bras* 1990]:

$$f_i = f_c + (f_0 - f_c)e^{-\alpha} \qquad 21$$

where f_0 is the maximum infiltration capacity and f_c is an asymptotic minimum value for infiltration (the infiltration rate reached after a long time period, and approximately equal to the saturated hydraulic conductivity.) The parameters α, f_0, and f_c are estimated from field data.

4.2.3 Green and Ampt Equation

A simple equation for infiltration was derived by *Green and Ampt* [1911]. This derivation preceded the work of Richard. This derivation is also based on a Darcy type water flux and assumes piston flow with a sharp wetting front. The infiltration rate f_i is proportional to the total gradient and can be written

$$f_i = \frac{K_s(H + p_f + z_f)}{z_f} \qquad 22$$

where K_s is a hydraulic conductivity, approximately equal to the saturated hydraulic conductivity, p_f is the pressure in the water phase at the wetting front, and z_f is the depth of the wetting front, and H is the depth of ponded water on the surface.

4.3 Leakage

Leakage refers to the exchange of water between the saturated zone and surface water bodies such as lakes or rivers. This exchange is usually incorporated into a model by including a leakage term between an aquifer and a standing body of water, usually modeled as a distributed fixed head source/sink, and possibly temporally variable. The exchange between surface and ground water can be influenced to a great degree by the conductance of the lake or river bottom, which can be quite low due to deposition of clay or peat.

The flux of water q between a surface water body and an aquifer is usually modeled by a simple Darcian flux term:

$$q = -K_b \frac{h_s - h_a}{b} \qquad 23$$

where K_b is the bed (lakebed or streambed) conductance, h_s is the piezometric head in the surface water body, h_a is the head in the adjacent aquifer, and b is the thickness of the bed.

4.4 Recharge

Recharge refers to the transport of water from the vadose zone into the saturated zone. This is called percolation by some authors, although percolation is also used to describe downward transport of water entirely within the vadose zone. If separate models are used to determine

subsurface flow in the vadose and saturated zones, perhaps the most straightforward way to model recharge is to simply determine it as a flux quantity at the lower boundary of a soil infiltration model. This flux term can then be used as the upper boundary condition of a saturated flow model. However, the exact depth of the water table can be difficult to determine, and given enough variability in infiltration rate or discharge from the saturated zone, the location of the water table (where the boundary condition is to be applied) is strongly dependent on the internal state of the system. If a single mathematical model is used to describe water flow in both the vadose and saturated zones, determination of recharge is a by-product of the modeling processes. This approach, however, can be computationally very expensive.

4.5 Capillary Rise

Capillary rise is the movement of water upwards from the saturated zone into the vadose zone. This rise is due to capillary forces in the partially saturated zone. As with recharge, if a single model is used to describe water flow in both the vadose and saturated zones, determination of the amount of water transferred to the vadose zone is a by-product of the solution process, and is dependent on the dynamics of water within the saturated zone and infiltration and evapotranspiration conditions at the upper boundary of the vadose zone. If separate models are used, this quantity must also be treated as a flux term at the lower boundary of the partially saturated zone/upper boundary of the saturated zone. Again, in this case, this boundary condition is strongly dependent on the internal state of the two systems.

4.6 Evaporation and Transpiration

4.6.1 Evaporation

Evaporation is the flux of water vapor into the atmosphere from soil or surface water. The two primary factors controlling evaporation from surface water are the energy supply needed to provide the latent heat of vaporization and the ability to transport the vapor away from the evaporative surface. Some of the approaches used to determine the evaporation rate are

Energy balance approaches rely on the fact that any evaporation occurring must be balanced by some combination of heat inputs from radiation or sensible heat from the atmosphere or ground and/or a loss of heat energy in the evaporating body. This is expressed with a relatively simple equation [*Chow et al.*, 1988]:

$$E = \frac{1}{l_v \rho_w}(R_n - H_s - G)$$

where E is the evaporation rate, l_v is the latent heat of evaporation, ρ_w is the density of water, R_n is the net radiation flux, H_s is the sensible heat flux, and G is the ground heat flux.

Aerodynamic or mass-transfer approaches estimate evaporation by utilizing the fact that the transport rate of water vapor is governed by the humidity gradient in the air near the surface and the wind speed across the surface. The evaporation rate E_a is given by [*Dingman*, 1994]

$$E_a = K_{\text{atm}} C_{\text{atm}} (e_s - e_a)$$

where K_{atm} is an atmospheric constant dependent on air pressure and the density of air and water, C_{atm} is the atmospheric conductance dependent on wind speed and the roughness height of the land

surface, e_s is the saturated vapor pressure at the ambient air temperature, and e_a is the ambient vapor pressure.

Combination approaches incorporate the two approaches above to estimate evaporation. *Penman* [1948] combined the energy balance approach with the mass-transfer approach to derive the equation [*Chow et al.*, 1988]:

$$E = \frac{\Delta}{\Delta + \gamma} E_r + \frac{\gamma}{\Delta + \gamma} E_a \qquad 24$$

where E_r and E_a are the evaporation rates computed from the rate of net radiation and aerodynamic methods, respectively, Δ is the gradient of the saturated vapor pressure curve, and γ is the psychrometric constant. This method is well suited for application to small areas with detailed climatological data, including net radiation, air temperature, humidity, wind speed, and air pressure.

Priestly–Taylor method. This method is a simplification of the Penman method discussed above, and is used when the data available is not sufficient to apply combination approaches [*Priestly and Taylor*, 1972]. For evaporation over very large areas, energy balance considerations tend to dominate the evaporation rate. In these cases, the Priestly-Taylor evaporation equation can be used

$$E = \alpha \frac{\Delta}{\Delta + \gamma} E_r$$

where α is and empirically derived constant approximately equal to 1.3 [*Chow et al.*, 1988].

4.6.2 Evapotranspiration

Transpiration is the discharge of water vapor into the atmosphere from plant stomata. The combined processes of evaporation and transpiration are referred to as evapotranspiration. The same energy supply and vapor transport factors that control evaporation also govern evapotranspiration. Potential evapotranspiration is the rate at which evapotranspiration would occur from a large area completely and uniformly covered with growing vegetation that has access to an unlimited supply of soil water. The actual evapotranspiration can found by multiplying the potential evapotranspiration by a factor that depends on the soil moisture content.

A widely used model for evapotranspiration is the Penman-Monteith equation, which is a modification of the Penman equation (equation [24]) that incorporates the atmospheric conductance (defined previously) and the canopy conductance C_{can}, which is dependent on vegetation type, solar radiation, humidity, air temperature, and soil moisture [*Dingman*, 1994]:

$$E = \frac{\Delta E_r + \gamma E_a}{\Delta + \gamma\left(1 + C_{atm} / C_{can}\right)} \qquad 25$$

This reduces to the Penman equation [24] as the canopy conductance becomes infinite.

4.6.3 Interception and Interception Loss

Interception occurs when precipitation falls on vegetation (as opposed to falling directly on the ground surface or on open water bodies) where it is subject to evaporation. A significant portion of the water that lands on vegetation is subsequently evaporated. This is a significant fraction of the total evapotranspiration in many areas. This loss is strongly dependent on the type of vegetation as well as the intensity, duration, and frequency of the precipitation. Empirical models have been developed using regression analysis. Conceptual models (e.g., *Rutter et al.* [1971]) are based on

water balance approaches with the amount of interception and loss determined as a function of canopy structure and evaporation models such as the Penman equation.

4.6.4 Interflow

Interflow refers to predominately horizontal flow occurring between the ground surface and a perched or regional water table. This terminology is widely used, but the exact transport mechanism is not well specified by most workers. It can refer to partially saturated Darcian flow (see section 3.4), to flow in macropores that bypass the soil matrix, or to flow in thin saturated zones above impermeable layers.

5 Surface Water/Ground Water Interaction Models

Over the past few decades, it has been increasingly recognized that in order to effectively model any given process in the hydrologic cycle, interactions with other processes in the cycle must be incorporated. As a result, there have been a number of models developed that include two or more hydrologic processes as well as several mechanisms for modeling interactions among the various processes. In virtually all of the cases reviewed, models of surface water/ground water interactions are based on pre-existing models of surface water or ground water processes with new functionality added to implement the coupling of processes and interactions.

The majority of these cases can be divided into two categories depending on how they add the new functionality. Those in the first category consist of "glue codes" that link two or more existing hydrologic models. The primary function of these "glue codes" is to exchange data between the existing models as well as to provide a framework that allows the models to iteratively arrive at a solution. Some widely used single process models that have been incorporated into surface/ground water interaction models are discussed below. Those in the second category build on pre-existing computer models by adding new modules or packages to the existing code to model a process or interaction that was not implemented in the original model.

5.1 Existing Hydrologic Models Utilized in Interaction Models

5.1.1 Ground Water Models

The majority of the models reviewed rely on MODFLOW to model ground water flow. MODFLOW is a well-known ground water modeling package developed by the U.S. Geological Survey [*McDonald and Harbaugh*, 1988]. MODFLOW uses a finite-difference technique to solve

the saturated ground water flow equations for flow in confined or unconfined aquifers. It has the advantage of being constructed in a modular format, and hydrologic processes can be relatively easily added as new packages. Several researchers have taken advantage of this format to add surface water packages to model a particular aspect of surface water/ground water interaction. Several of the models reviewed use saturated ground water flow models that are similar to MODFLOW in that they utilize a finite-difference technique to solve the ground water flow equations in the form given in equation [11].

Other types of ground water flow models besides finite-difference based techniques have been used in integrated surface water/ground water models as well. AQUIFEM-N [*Wilson et al.*, 1979; *Townley and Wilson*, 1980; *Anderson and Woessner*, 1992] is a multi-layered quasi-3D saturated ground water flow model that uses a finite-element method to solve the ground water flow equations. It uses linear triangular elements to represent the geometry of an aquifer and has several options for assigning the spatial distributions of aquifer properties and the spatial and temporal distributions of boundary values. AQUIFEM-N models steady and transient groundwater flow in a single aquifer or in a system of coupled aquifers.

5.1.2 Surface Water Models

SWAT (Soil and Water Assessment Tool) is a watershed scale model developed to predict the impact of land management practices on water, sediment and agricultural chemical yields in large complex watersheds. SWAT is based on the water balance equation and is a continuous, physically based, rural, large-basin model that operates on a daily time step. It was developed from the existing agriculturally-based model SWRRB [*Williams et al.*, 1985; *Arnold et al.*, 1990; *Arnold et al.*, 1993] by adding a simple ground water flow model. The physical hydrological processes

modeled include surface runoff, return flow, percolation, lateral subsurface flow, evapotranspiration, transmission losses, pond/reservoir storage, groundwater flow, river-reach routing, and water transfer. A distributed SCS curve number is generated for the computation of overland flow runoff volume. A soil database is used to obtain information on soil type, texture, depth, and hydrologic classification. Infiltration is defined in SWAT as precipitation minus runoff. Infiltration moves into the soil profile where it is routed through the soil layers (of which there can be up to ten defined). A storage routing flow coefficient is used to predict flow through each soil layer, with flow occurring when a layer exceeds field capacity. Since it is physically based, it requires specific input information regarding weather, soil properties, topography, vegetation, and land management practices, rather than relying on regression equations to describe the relationship between input and output variables. The ground water modeling component is a lumped model that uses a water balance approach for a shallow and deep aquifer. When water percolates past the bottom layer, it enters the shallow aquifer zone [*Arnold et al.*, 1993]. Channel transmission loss and pond/reservoir seepage replenishes the shallow aquifer while the shallow aquifer interacts directly with the stream. Flow to the deep aquifer system is effectively lost and cannot return to the stream.

HSPF (Hydrologic Simulation Program-Fortran) HSPF simulates hydrologic and associated water quality processes on land surfaces and in streams and well-mixed impoundments for extended periods of time. HSPF is a continuous, lumped parameter model that uses input rainfall and other meteorologic records to compute streamflow hydrographs. It simulates interception, soil moisture, surface runoff, interflow, base flow, snowpack depth and water content, snowmelt, evapotranspiration, ground-water recharge, temperature, as well as modeling transport of a wide variety of chemicals and sediment types. In HSPF, rainfall and snowmelt are subject to interception storage. Overflow from interception storage plus surface external lateral inflow produces total

inflow into surface detention storage. This inflow, plus existing water in surface detention storage is available for infiltration and runoff. Infiltration uses Philip's method with the infiltration capacity a function of the soil permeability, land slope, soil surface conditions, and soil moisture content. Water that has directly infiltrated moves to the lower zone and ground water storage. Other water may go into upper zone storage, may be routed as runoff from surface detention or interflow storage, or may stay on the surface from which it may infiltrate or runoff at a later time. Water percolating from upper zone storage to lower zone storage may flow to active ground water, which eventually reappears as baseflow, or may be permanently lost to the system through deep percolation (inactive ground water). Percolation from the upper zone to the lower zone is a function of the difference in soil moisture content between the two zones. The distribution of water between active and inactive ground water is determined by the user. Actual evapotranspiration is determined as a function of potential evapotranspiration (which is determined from pan evaporation data) and the amount of moisture available in the various storages. The sources of moisture available for evapotranspiration are baseflow, interception storage, upper zone storage, active groundwater, and lower zone storage. Routing of surface water through a channel network is accomplished using a kinematic wave method.

HSPF is generally used to assess the effects of land-use change, reservoir operations, point or nonpoint source treatment alternatives, flow diversions, etc. The model was developed in the early 1960's as the Stanford Watershed Model. Subsequent additions include water-quality processes, pre- and post-processing software, and algorithm enhancements.

SWMM (Storm Water Management Model) was developed by the EPA to simulate and perform analysis of quantity and quality problems associated with urban runoff. It can be used for either continuous or event-based simulations of catchments having storm sewers, or combined sewers and

natural drainage, for prediction of flows, stages and pollutant concentrations. SWMM can simulate urban hydrologic and water quality cycles, including rainfall, snowmelt, surface and subsurface runoff, flow routing through the drainage network, storage and treatment. Flow routing can be modeled using a nonlinear reservoir approach, a kinematic wave model, or the complete dynamic flow routing equations (St. Venant equations). A lumped storage scheme is applied for modeling ground water flow, unsaturated zone flow, and outflow from aquifers into streams or channels. Infiltration is modeled using either the Horton or Green-Ampt equations (Equations 21 and 22, respectively). Data requirements for runoff modeling include area, imperviousness, slope, roughness, width (a shape factor), depression storage, and infiltration parameters.

5.2 Coupled Models of Surface Water/Ground Water Interactions

5.2.1 Models Coupling a Limited Number of Processes

The majority of the studies reviewed focused on coupling only a few hydrologic processes, such as aquifer-stream or aquifer-lake interactions. While these do not constitute "fully integrated surface water/ground water models", they are necessary components of larger models, and many of the techniques developed in these studies can be incorporated into larger models.

Models of aquifer/stream interactions: Several packages have been developed for MODFLOW to add the capability of modeling exchange between aquifers and streams/rivers. Leakage between channels and the aquifer (see section 4.3) was originally computed using the River package, which maintains a constant stage in the channel and computes leakage across a confining riverbed (see *Swain* [1993,1994]). The dynamics of flow in the channel are not modeled and the channel simply acts as an infinite source or sink.

Subsequently, the Stream package was developed by *Prudic* [1989] to represent flow conditions in the channel. In this package, inflows and leakages are instantaneously routed downstream, and the stage in the channel can be user specified or determined using Manning's equation [4]. However, the Stream package has some deficiencies in that it cannot model time-variant flows, reversal of flow, or non-rectangular channel cross-sections. To remedy this, the MODBRANCH model was developed, which links MODFLOW with the pre-existing unsteady channel flow model BRANCH [*Swain and Wexler*, 1993]. BRANCH is based on the full dynamic flow equations and can model time-variant flow, backwater conditions, river junctions with varying flows, reversal of flows, and non-rectangular cross-sections. The linking between BRANCH and MODFLOW (creating MODBRANCH) is accomplished by incorporation of a leakage term between the two. However, in many applications, MODBRANCH can be unnecessarily complex and the simpler packages can give adequate results. To take advantage of simpler models, *Swain* [1993, 1994] developed the Streamlink package, which links the River, Stream, and MODBRANCH programs with MODFLOW. When a simple model for channel flow will suffice, the simpler packages are used. When more complex systems need to be modeled MODBRANCH can be used. In a similar fashion, *Perkins and Koussis* [1996] developed a stream-aquifer interaction model using MODFLOW to solve the saturated ground water flow equation with a Muskingum-Cunge diffusive-wave routing scheme to solve the channel flow equations.

In addition to modeling exchange between aquifers and streams as a leakage, the Streamlink package developed by *Swain* [1993, 1994] also allows for exchange between streams and an aquifer block as a direct-flow connection. This is most significant when the aquifer block represents a wetland, lake, or overland flow layer. This is discussed below in relation to models of aquifer/wetland interactions.

In the packages discussed in the proceeding paragraphs, the exchange between rivers and ground water is handled by incorporating a leakage term (such as in equation [23].) This provides a mechanism to determine the quantity of water exchanged between an aquifer and stream, as well as the direction of flux.

Pucci and Pope [1995] used MODFLOW to model ground water and surface water interactions in New Jersey. "Stream cells" were used in the aquifer grid to model discharges into the regional river system. However, they did not specifically discuss the method by which the discharge into the streams was calculated.

Models of aquifer/lake interactions: Several models of aquifer/lake interactions were reviewed. These include studies by *Merritt and Konikow* [2000], *Cheng and Anderson* [1993], and *Winter* [1983]. The first two studies both use MODFLOW to model saturated ground water flow in a fashion similar to the stream/aquifer models discussed above. In both cases a leakage term is used to determine the exchange of water between the aquifer and the lake, which is represented by a volume of space within the model grid comprised of inactive cells. The packages calculate the lake levels based on a water balance approach and uses the calculated lake levels to estimate ground water fluxes. The relative heads and conductances between aquifer and lake grid cells determine the rate of water exchange. In this way the package can model the dynamic exchange of water between a lake and the underlying ground water system. The lakebed conductances are specified by the user. The package developed by *Cheng and Anderson* [1993] accommodates precipitation to the lake, evaporation from the lake surface, steam flow, and ground water fluxes. *Winter* [1983] used a vertical two-dimensional finite element model to approximate a solution to Richard's equation for partially- to fully-saturated ground water flow. This approximate solution is used to determine

exchange of water between lakes and a partially- to fully-saturated porous media. The lake levels are held constant, but the water table is allowed to move freely within the porous medium.

Models of aquifer/wetland interactions: The Streamlink model developed by *Swain* [1993, 1994] can also model direct transfer of water between rivers and wetlands using MODFLOW and MODBRANCH. The wetland is treated as an aquifer layer within MODFLOW, and a channel can either discharge onto the layer or receive flow directly from the aquifer layer. A discharge value is calculated at the river stage boundary, which can either be into or out of the channel, and is subtracted or added to the water budget in the aquifer block. The head in the wetlands is then calculated, to which the channel boundary stage is equated. This procedure iterates until it converges towards a solution.

Restrepo et al. [1998] developed a wetland simulation module for MODFLOW that models sheet flow through dense vegetation and channel flow through a slough network. Instead of the Darcy equation [7], a form of the Manning equation [4] is used to represent surface water movement. The sheet flow zone is represented as a type of porous medium that, together with plant stems and soil, forms a layer that interacts with the underlying aquifer. Sheet flow is simulated with MODFLOW as uniform flow through dense vegetation in a three-dimensional formulation. Channel flow through a slough network is modeled using a cell-by-cell anisotropy factor to create preferential flow directions. Wetland/aquifer interactions are modeled using the horizontal and vertical interblock conductance and computing a head value at the center of each cell, which is assumed to represent an average head value in each block. This is done on a cell-by-cell basis. The wetland areas contribute or receive water from the aquifer depending on the head gradient between the wetland and the aquifer. The interactions in the vertical directions between the wetland areas and the aquifer are computed using a Darcy flow equation.

5.2.2 Models Coupling Many Hydrologic Processes

While there are a relatively large number of hydrologic models that incorporate a large number of surficial hydrologic processes, relatively few of them utilize a spatially distributed (non-lumped) ground water modeling component. The studies discussed here are those that at a minimum incorporate a distributed ground water model with a variety of surficial hydrologic processes.

As with the models discussed above, most of the hydrologic models discussed in this section rely on MODFLOW or a similar two- or quasi-three-dimensional finite-difference technique to model ground water flow. An alternative to this approach is to use a finite-element technique to approximate a solution to the ground water flow equations. While a finite-element method is somewhat more difficult to implement and can be computationally more expensive to run, it offers advantages in that the discretization is more adaptable to irregular boundaries, and a wider variety of boundary conditions can be incorporated into the model. Two models discussed here that use finite-element methods to model ground water flow are those developed by *Chiew et al.* [1992] that used the ground water model AQUIFEM-N; and that developed by *Wolf and Helgesen* [1993] which used a two-dimensional finite element model.

MODFLOW/finite difference based ground water models: *Sophocleous et al.* [1993] developed and implemented a comprehensive model capable of simulating surface and ground water flow and stream-aquifer interactions on a continuous basis for the Rattlesnake Creek basin in south-central Kansas. This was accomplished by linking the agriculturally based model SWAT [*Arnold et al.*, 1993] with MODFLOW. The resulting model was named SWATMOD. The developers were associated with the Kansas Geological Survey, the University of Kansas, Kansas State University, and Purdue University. The processes and interactions included in model include surface runoff, infiltration, recharge, pond/lake seepage, transmission losses, subsurface lateral flow, pumped

ground water used for irrigation, evapotranspiration, evaporation from ponds, and leakage across streambeds. In order to accomplish the linkage, two major subroutines were added that are called at the end of each simulated aquifer time step to pass data between MODFLOW and SWAT. A subroutine called MODSWB associates the geographic domain of the subbasins represented by SWAT with the aquifer grid domain and stream network defined in MODFLOW and converts the hydrologic fluxes calculated by SWAT for each time step into flow rates for recharge, tributary flow, and both surface and ground water diversions. SWAT simulates one main stream reach within each subbasin. The model is limited to a single channel width, roughness, conductivity, etc., for each subbasin.

SDI Environmental Services [*SDI*, 1997] developed an integrated surface and ground water model (ISGW) for the West Coast Regional Supply Authority in Clearwater, Florida. This model was constructed by linking the surface water modeling program HSPF with MODFLOW. The model was used to evaluate water resources for a study area in the Tampa Bay area in west central Florida. The model ISGW is an extension of a public domain model FHM (Florida Institute of Phosphate Research (FIPR) Hydrologic Model, [*Bromwell & Carrier, Inc., et al.*, 1991]), which first integrated HSPF and MODFLOW with a geographic information system (GIS). Hydrologic processes incorporated into this integrated model include precipitation, spring flow, surface water runoff, baseflow, evapotranspiration, and ground water recharge and discharge. Through the GIS, the integrated model links the corresponding subbasin and reach numbers from HSPF to individual cells in MODFLOW.

The South Florida Water Management Model (SFWMM) [*South Florida Water Management District*, 1999] is used by the South Florida Water Management District to evaluate the interaction of water supply and demand with hydrologic conditions in several counties in south Florida. The

SFWMM is a regional-scale computer model that simulates the hydrology and the management of the water resources system from Lake Okeechobee to Florida Bay. It covers an area of 7600 square miles using a mesh of 2 mile x 2 mile cells. The model simulates the major components of the hydrologic cycle including rainfall, evapotranspiration, infiltration, overland and groundwater flow, canal flow, canal-groundwater seepage, levee seepage and groundwater pumping. The model uses a daily time step to simulate hydrologic processes.

Overland flow in the SFWMM involves the movement of water from cell-to-cell, cell-to-canal, or canal-to-cell. Cell-to-cell overland flow is simulated using a two-dimensional diffusion flow model with Manning's equation used to describe bottom resistance effects. A two dimensional finite difference approximation of the governing equations for overland flow is used to calculate the flow velocities. Infiltration into the soil is taken as the minimum of 1) the available surface water, 2) the infiltration rate multiplied by grid cell area and time step, or 3) available void space between the land surface and the water table. Seepage between canals and ground water is modeled using a leakage term dependent on the head difference between the canal and the underlying aquifer and the canal bed conductivity. Seepage of ground water beneath and through levees is modeled empirically. A two-dimensional finite difference method, based on the Dupuit approximations (see Section 3.3.2 and Equation [11]), is used to model the regional ground water flow in an anisotropic, heterogeneous, unconfined aquifer. This modeling approach is similar to MODFLOW. Canal flow routing is accomplished through a mass balance approach that accounts for changes in storage within a reach. The mass balance is performed at each time step (1 day). Evapotranspiration in the model is based on a reference crop ET that is adjusted according to crop type, available soil moisture, and location of the water table.

MIKE SHE is an integrated surface water/ground water models developed by the Danish Hydrologic Institute. This model has been used by the South Florida Water Management District for integrated surface water/ground water modeling [*Yan et al.* 1998]. A number of integrated surface and ground water processes can be modeled, including transient fully- and partially-saturated ground water flow. The ground water component computes transient groundwater flow and head in a 3D finite difference grid based on the given boundary conditions and interaction with other components included in the model. Flow in the vadose zone is modeled as a one-dimensional process using Richards' equation or a computationally simpler gravity flow equation. The vadose and saturated zones are coupled in order to compute the correct soil moisture and the water table dynamics in the lower part of the soil profile. Percolation and capillary rise are also modeled within the vadose zone.

Surficial processes modeled within MIKE SHE include overland flow and channel flow. Temporary surface storage accumulated during rainfall events or rising of the water table to the surface results in overland flow to the channel system and with subsequent discharge at the catchment outlet. Evaporation and/or infiltration during channel transport are also incorporated into the model. Overland flow velocities and water depths are described using a one-dimensional diffusive wave approximation of the Saint-Venant equation with the Manning formulation for friction slope. River-aquifer exchange can be modeled in two ways, where either the river is in full contact with the groundwater aquifer, or a riverbed lining of low permeability separates the river from the groundwater aquifer.

Two formulations of the interception/ evapotranspiration process can be used in MIKE SHE. One is the Rutter model/Penman-Monteith equation, which calculates the evaporation, the actual storage on the canopy, and the net rainfall reaching the ground surface as canopy drainage and throughfall,

with the actual evapotranspiration rates calculated by the Penman-Monteith equation using canopy resistances. The potential evapotranspiration is calculated using climatological and vegetation data. The second is the Kristensen-Jensen model, where the interception storage is calculated based on actual leaf area index and an interception capacity coefficient. The net rainfall is calculated by a simple water balance approach. The actual evapotranspiration is calculated on the basis of potential rates and the actual soil moisture status in the root zone.

Finite-Element Based Models: *Chiew et al.* [1992] describe an integrated surface and ground water modeling approach that couples the surface water model HYDROLOG [*Chiew and McMahon*, 1990] with a finite element ground water model AQUIFEM-N. The integrated model was applied to irrigated and non-irrigated areas in part of the Campaspe River Basin in north-central Victoria, Australia. HYDROLOG was used to estimate daily recharge rates that were added as fluxes to the uppermost aquifer. HYDROLOG models several surficial hydrological processes, among them interception storage of precipitation, infiltration, interflow, surface storage, surface runoff, channel store, streamflow, depression flow/storage, baseflow, and recharge. Rainfall enters interception storage until the storage is filled. The interception storage is emptied at the end of each day by evaporation. Overflow from the interception storage is then subject to infiltration, which is controlled by a function based on Philip's equation and is essentially expressed as an exponential function of soil moisture. The water that does not infiltrate is partitioned between depression storage and runoff into streams. Moisture that has infiltrated into the soil is subject to evapotranspiration. Excess moisture in soil storage overflows to ground water storage. Water in ground water storage can be depleted by baseflow into streams and deep seepage. In the integrated model the deep seepage is input as recharge to the ground water model AQUIFEM-N. AQUIFEM-N uses these recharges and in turn provides a solution to the flow between the river and the water

table aquifer at each specified head node representing a stream. These inflows/outflows are then added to provide the total amount of flow between the river and aquifer.

Wolf and Helgesen [1993] use a finite element code [*Dunlap et al.*, 1984; *Wexler and Maus*, 1988] to model ground water flow, volume of stream flow, and simulate the interaction between stream flow and ground water. The model is applied to the Kansas River and its associated alluvial aquifer in the Wamego-Topeka area in northeastern Kansas. The Model numerically solves the equation for two-dimensional ground water flow in an unconfined aquifer (Equation [11]). The model accounts for transient conditions of stream flow and provides an itemized stream-aquifer water budget. The surface water routing routine is not a true surface water flow model, but rather is an accounting program that tracks the flow in the stream as it interacts with the aquifer.

The model uses an algorithm developed by the *U.S. Department of Agriculture* [1967] to partition water applied through precipitation and irrigation between evapotranspiration and deep percolation (recharge to the saturated zone). The partitioning is a function of potential evapotranspiration, rate of water application, and the moisture capacity of the soil zone. Runoff and surface storage (other than river storage) are not incorporated into the model. Besides deep percolation, other sources of recharge to the aquifer include subsurface lateral inflow along the model boundaries (achieved through fixed-head boundary conditions) and recharge from the Kansas River. Most of the interaction between the river and the aquifer is discharge from the aquiver, however. Other sources of discharge include pumping for irrigation and evapotranspiration. Evapotranspiration from the saturated zone will occur if the water table shallow enough so that it lies within the root zone, and if potential evapotranspiration exceeds the applied water rate.

A two-dimensional triangular mesh is used to discretize the alluvial plain. Nodes in the finite element mesh are located along the river and are used to route stream flow and provide for the

simulation of stream-aquifer interconnection. Tributary inflow is simulated at those river nodes representing the mouth of each tributary and aquifer discharge to tributary streams is simulated by placing pumping wells along the routes of larger tributaries. Direct simulation of stream-aquifer interaction is only done on the main reach of the Kansas River. Ground water/surface water interaction is represented by leakage between the aquifer and the river. The leakage is computed according to Equation [23], where the flux between river and aquifer is dependent on the relative head between aquifer and river and the riverbed conductance. This approach is similar to the river/aquifer and lake/aquifer interaction models discussed above.

6 Conclusions

Development of an integrated surface water/ground water model requires incorporating many different hydrologic processes as well as interactions between processes. While there are many existing models of the hydrologic processes, relatively few models incorporating both detailed surface water and ground water processes have been developed. These integrated models are, with few exceptions, either combinations of existing hydrologic models that have been linked together in some way, or extensions of established hydrologic models. For the most part, these integrated surface water/ground water models have been developed for application to a specific geographic area. As a result, many of the processes and interactions included have been tailored to that region. Consequently, some hydrologic processes and/or interactions may be neglected entirely, since not all processes and interactions discussed above are relevant in all areas. This approach is necessary, however, since inclusion of unneeded processes significantly complicates implementing a model. As more processes are included, data requirements to sufficiently parameterize the model, characterize interactions, and provide the necessary initial and boundary conditions can become overwhelming. Unfortunately, a consequence of this approach is that it makes any sort of performance-based comparison between models difficult or impossible.

To reiterate, we are faced with the following problems in trying to evaluate alternative models of surface water/ground water interaction:

1) Different models of surface water/ground water interaction do not necessarily incorporate the same hydrologic processes and interactions.

2) Since each model can approach the representation of a process in a different manner through the use of different governing equations or approximations for a given process,

there is no guarantee that the parameters required by the various models are the same, even when the simulated processes are the same.

3) It follows immediately from 2) that there is no straightforward way to develop a common reference dataset on which to test the models.

For the most part, the integrated models reviewed here are academic, combined academic/government, or limited "test case" efforts. This leads to another problem in evaluating the applicability and effectiveness of the models: implementation details with respect to the specific mathematical and computer techniques utilized are rarely given in full. In contrast, many public domain computer programs for modeling hydrologic processes (such as MODFLOW and others developed by governmental agencies) do include users manuals that have many implementation details. As a result, if an integrated model consists of linked public domain computer codes, those public domain parts of the model are frequently well documented.

At this point, it is unknown if SFWMM is available for use outside of the South Florida Water Management District. If it is available for use, its usefulness may be in question due to the fact that it is very specific to the hydrologic processes and management practices of south Florida, and thus it is doubtful that it could be easily applied to other regions.

MIKE SHE, in contrast, is a commercially available product and is designed to be applicable to a range of locations and situations. However, unlike the SFWMM, detailed information regarding implementation techniques is not immediately available, which makes determination of its applicability to any given problem difficult.

7 Recommendations

Before choosing a specific model to apply to a given problem, a number of issues need to be examined and addressed for each candidate model under consideration. The primary consideration is simply that the model should fit the problem at hand. While this recommendation may appear self-evident, it is the primary consideration in selecting a particular integrated surface water/ground water model. There are several points that should be considered in this context:

- It is critical to correctly identify the hydrologic processes and interactions that are active in the study area, and to ensure that these processes and interactions are simulated in the candidate models.
- A detailed review of how each candidate model addresses each hydrologic component with respect to incorporation of the most recent advances and techniques in modeling that process is necessary.
- The parameters in the governing equations, as well as the initial and boundary conditions required by the selected model must be readily identifiable and measurable in the field.
- The model has to be capable of providing the desired results.
- Each of the simulated hydrologic processes and interactions in the model should be validated, both individually and as an integrated whole.
- A reference dataset should be constructed, implemented, and verified. Specific performance measures should be constructed and included.

8 Problem Application to Tiger Bay Canal and Bennett Swamp

This section presents a demonstration on how various factors are considered to select a specific set of modeling tools to develop and apply an integrated ground water/surface water model to the Tiger Bay Canal watershed and Bennett Swamp in Volusia County, Florida.

8.1 Background

The combined drainage area of Tiger Bay Canal and Bennett Swamp represents a 30.64 sq mi watershed located in Volusia County, Florida. This watershed is particularly important because proper management could yield moderate recharge to the Floridan aquifer [*Rutledge,* 1985], which is the primary source of potable for Volusia County residents. Wellfields, located along the Rima Ridge, that runs north and south between the Tiger Bay area and Bennett Swamp, were recently constructed to meet the current demands of Daytona Beach.

Tiger Bay Canal watershed (that is not including Bennett Swamp) is approximately 7 miles long and 3 miles wide and drains 26.19 sq mi. Geographically, it extends from the Rima Ridge on the east to another ridge 3 miles to the west, and from about 0.5 miles north of S.R. 44 to a mile north of U.S. 92. A natural cut through the Rima Ridge allows runoff from Tiger Bay Canal to flow into Bennett Swamp. From here a portion of runoff discharges directly to the Tomoka River by way of the Thayer Canal, while the remainder spills south before it discharges to the Tomoka River from the U.S. 92 drainage canal.

Proper management of both surface and ground water resources within the Tiger Bay Canal watershed and Bennett Swamp is important to preserving local wetlands and the Floridan aquifer. Recognizing this, Volusia County and the SJRWMD jointly funded a study of the feasibility of

altering the existing drainage system to delay runoff [*Camp Dresser and McKee* (*CDM*), 1996 and *SJRWMD*, 1998]. The study lead to a two-phase examination of proposed weirs and potential sites of weir installations for the purpose of restoring high water table levels lost through groundwater seepage to canals and wellfield pumpage.

To conduct this study various hydraulic and hydrologic models were coupled together to simulate overland flow, open channel flow, infiltration, saturated groundwater flow, and evapotranspiration. In the most recent Phase II of the study [*SJRWMD,* 1998], storm runoff hydrographs were generated for each subbasin using the U.S. Environmental Protection Agency's storm water management model (SWMM). This basin model simulates most of the process described above; however, limited utilities are provided for simulating surface/groundwater interactions and saturated groundwater flow. The SWMM generated runoff volumes and rates were next used to generate surface water profiles in Thayer Canal and Bennett Swamp using HEC-2, a model developed by the U.S. Army Corps of Engineers, and in Tiger Bay Canal using HEC-RAS, an improved windows version of HEC-2 [*SJRWMD*, 1998].

8.2 Pertinent Findings from Modeling Efforts

The development of an integrated surface water/ground water model requires incorporating many different processes as well as interactions between process. The modeling conducted by *CDM* [1996] and *SJRWMD* [1998] represents sequential efforts to develop an integrated surface water/ground water model for the watershed drained by Tiger Bay Canal and Bennett Swamp. However, for each effort, several findings were identified that suggest technical improvements for future modeling efforts. What follows is a listing of the most salient findings extracted from the text of *SJRWMD* [1998] and to a lesser extent *CDM* [1996].

1) There was an overestimation of total evaporation losses during flooding events because losses were computed twice over the same area, i.e., evapotranspiration losses were calculated from the forest canopy and again as evaporation from ponded water under the canopy.

2) The models selected could not simulate the minimum base flows in canals and in the swamp. These minimum flows typically occur subsequent to runoff events. A *more sophisticated model, one capable of simulating extreme transient interactions between surface and subsurface hydrologic components, is needed to perform such simulations.*

3) Deep percolation was referred to as the "coefficient of unquantified losses" because it included other unknown losses such a shallow groundwater movement from one subbasin to the next. *A fully integrated surface water/ground water model would characterize the exchange of water between surface-to-surface, surface-to-subsurface and subsurface-to-subsurface hydrologic components.*

4) Deep percolation or recharge to the Upper Floridan aquifer was calculated using Darcy's equation and the difference in head between the Upper Floridan aquifer and the simulated water table. Upper Floridan aquifer levels were derived from a steady-state groundwater model and treated as fixed parameters during transient simulations of overlying surface water/ground water interactions. SWMM as a model could not handle transient changes in Floridan aquifer levels. *A fully integrated surface water/ground water model would characterize the transient exchange of water between surface-to-subsurface subsystems using coupled transient components.*

5) Leakance rates given by *Williams [1997]* and those calibrated for Tiger Bay Canal watershed did not match. *This was expected given* Williams *[1997] developed a steady-*

state groundwater model assuming time-averaged source and sink terms (i.e., wells, evapotranspiration, and percolation). The transient modeling in general requires additional system parameters beyond those required under steady-state conditions. These additional parameters are generally time-invariant while induced stresses and predicted fluxes are transient.

6) Backwater computations were made with HEC-2 and HEC-RAS rather than with SWMM because less effort was required to model multiple backwater profiles and multiple culverts. *This finding suggests that future integrated surface water/ground water models be designed to handle complex systems but not be complicated to use.*

7) The models selected for analysis could not vary Manning's "*n*" with respect to discharge when it was required in multiple profile simulations.

8) The watershed model assigns all surface runoff to the upstream end of the channel rather than distributing it along the length of the channel; as a result, runoff travel times are greater than observed. *Future models should permit distributed runoff loading to channels.*

9) Along Indian Lake Road, surface runoff from various buildings and facilities is routed to detention ponds for water quality and flood control purposes. *Future integrated surface water/ground water model should include utilities for simulating detention storage and the reduction runoff achieved for small rainfall events.*

10) SJRWMD suggested there could be water mass balance errors occurring in the groundwater subroutine. *Future models should include utilities for monitoring mass balances throughout the hydrologic systems.*

11) Peak discharges in Thayer Canal were being overly attenuated; as a result the 4000-ft wide channel bottom for Bennett Swamp was narrowed to 10 feet and given a 1 on 500 ft side slope. *A calibrated watershed model should exhibit an array of parameter values that reflect the physical dimensions of the system. However, as noted by* SJRWMD *[1998] reported model parameter values in the SWMM are not necessarily representative of the actual values. This is due to the great number of model parameters, and the fact that many combinations of parameter values will result in approximately the same model output.*

12) An artificial weir of 0.15 foot above the channel invert of Bennett Swamp was needed to attenuate small discharge surges entering Bennett swamp *SJRWMD* [1998]. U*se of artificial structures is difficult to defend, as it suggests the model is functioning improperly and/or that the physical characterization of watershed is inadequate.*

13) To obtain groundwater seepage rates to Thayer Canal that match recorded levels, it was necessary 1) to reduce the drainage area of subbasin 350 by 50 percent and 2) to decrease deep percolation in Bennett Swamp. The lower deep percolation rate was needed otherwise simulations would not exhibit the slow water table recessions that accompany prolongs seepage. *Artificial modifications of the physical domain such as these are difficult to defend, as it suggests the model is functioning improperly and/or that there is inadequate physical characterization of the system to simulate surface water/ground water interactions.*

14) SWMM cannot compute seepage from the channel back into the shallow aquifer. It only computes evaporation losses from the channel surface water area.

15) Initial model runs produced unrealistically high water tables in upland soils, so the deep percolation rate was increased 300 percent. *Changes of this magnitude suggest more information is needed on deep percolation rates.*

8.3 Specific Recommendations for the Tiger Bay Canal and Bennett Swamp

Based primarily on the extensive modeling conducted by *SJRWMD* [1998] and to a lesser degree on the efforts of *CDM* [1996] several recommendations can be made concerning future efforts to development of an integrated surface water/ground water model for the watershed drained by Tiger Bay Canal and Bennett Swamp. These recommendations address first the model and the simulated hydrologic intra-storage processes and interactions; second modeling concerns identified from previous modeling studies; and finally specific issues pertinent to hydraulic and hydrologic data needs.

With regards to the model and the hydrologic intra-storage processes and interactions to be simulated, there are three simple recommendations:

1) It is recommended that MIKE SHE be adopted as the integrated surface water/ground water model. This recommendation is based on three separate considerations. First because MIKE SHE can simulate all the salient hydrologic intra-storage processes and interactions, second because it is widely applied and hence has associated with it an extensive record of application, and third it is commercially supported. The latter consideration is important, because the existing vendor will customize MIKE SHE for specific applications and provide technical support.

2) Given the complexity of the Tiger Bay Canal watershed and Bennett Swamp, it is recommended that the intra-storage hydrologic processes simulated with the MIKE SHE include 3-dimensional saturated groundwater flow, 1-dimensional vertical unsaturated flow, channel flow and overland flow.

3) Finally, it is recommended that the hydrologic interactions simulated with the MIKE SHE include infiltration, seepage, recharge, evapotranspiration, overland flow and possibly leakage (only if pseudo-3-dimensional saturated porous flow is performed).

With regards to modeling concerns identified from previous modeling studies, there are six recommendations:

1) It is recommended that the model be designed to simulate the full range of base flows in canals and in the swamp. This would include the minimum flows frequently observed subsequent to runoff events.

2) It is important to quantify the exchange of water between all surface-to-surface, surface-to-subsurface and subsurface-to-subsurface hydrologic components; hence, it is recommended that MIKE SHE be modified to calculate mass balances between system components.

3) It is recommended that the watershed model simulate the transient exchange of water between surface-to-subsurface subsystems using coupled transient surface/subsurface components.

4) It is recommended that MIKE SHE be applied to perform simulations using Manning's "*n*" that varies with respect to discharge as required in multiple profile simulations.

5) It is recommended that MIKE SHE be applied in a mode that distributes runoff along the length of all channels.

6) It is recommended that MIKE SHE be applied to investigate the bi-directional exchange of water that occurs between the existing open channel system and the underlying subsurface.

With regards to specific issues pertinent to hydraulic and hydrologic data needs, several recommendations are made:

1) A monitoring program is needed for evapotranspiration throughout the study area. The single greatest water loss component within the watershed is evapotranspiration; however, there are no published data regarding potential evapotranspiration for native vegetation in the area.

2) *SJRWMD* [1998] suggested that had sufficient rainfall been available further calibration of the evapotranspiration would have been feasible; currently there are no rainfall gages within the study area. It is recommended that rainfall measurement stations be established within the Tiger Bay Canal watershed and Bennett Swamp. The additional rainfall stations are expected to provide data to further calibrated and verify event-based modeling. Furthermore, for the purpose of understanding results generated from long-term simulations, it may be valuable to compare rainfall data collected within the watershed against measurements taken at Tomoka Fire Tower, Daytona Beach Airport and Deland.

3) Two USGS stream gages exist in the study area more are recommended. These gages are especially important wherever seepage is considered significant. These new gages would also provide additional the stage discharge data needed to calibrate and verify the model.

4) It was recommended above that the watershed model be designed to quantify the occurrence of transient groundwater seepage. To calibrate such a model, it is recommended that additional groundwater data be collected to assess the direction and magnitude of water flowing between the subsurface and the various elements of surface water conveyance (canals and swamps).

5) *CDM* [1996] recommended 1-foot contour interval maps based on aerial photogrammetry are needed. This recommendation is still valid.

6) The 'effective depth of the root zone' DET was identified by *SJRWMD* [1998] as one of the most important calibration parameters. After initially underestimating the effective depth and range of evapotranspiration, depths were increased 50% to reduce runoff volumes. It is recommended that data be collected to verify these depths ranging from 3.0 feet for pine flatwoods to 9.0 feet for upland soils located along Indian Lake Road.

7) Initial model runs produced unrealistically high water tables in upland soils, so the deep percolation rate was increased 300 percent. It is recommended that groundwater data be collected to verify these fluxes.

8) Model simulations suggest that groundwater seepage is limited to a few subbasins (85f and 85w). For those few, calibration of model parameters required adjustments on the order of 2000 percent. It is recommended that field monitoring be established to verify pertinent model parameters and water fluxes.

9) The tail water elevation had the greatest impact on seepage volume and duration. It is recommended that this parameter and its associated impacts on seepage rates be thoroughly investigated in the field.

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10 Internet Links

This is a short list of internet links to web sites relating to hydrologic models discussed in the previous sections. Each site, government or commercial, has a short description of the model, together with information on how to obtain the model.

10.1 Surface Water Models

10.1.1 SWMM

10.1.1.1 Original (EPA) SWMM

http://www.epa.gov/ednnrmrl/tools/model/swmm.htm

http://www.epa.gov/earth100/records/swmm.html

http://www.chi.on.ca/swmm.html

http://www.ccee.orst.edu/swmm/

10.1.1.2 MIKE SWMM

http://www.bossintl.com/html/mike_swmm_overview.html

http://www.mikeswmm.com/

10.1.2 HSPF

http://water.usgs.gov/software/hspf.html

http://www.hydrocomp.com/HSPFinfo.htm

http://www.scisoftware.com/products/hspf_model_overview/hspf_model_overview.html

10.1.3 SWAT

http://www.brc.tamus.edu/swat/

10.2 Ground Water Models

10.2.1 MODFLOW

http://water.usgs.gov/software/modflow-96.html

10.2.2 AQUIFEM-N

http://www.scisoftware.com/products/aquifem-n_details/aquifem-n_details.html

10.3 Integrated Surface and Ground Water Models

10.3.1 South Florida Water Management Model

http://www.sfwmd.gov/org/pld/hsm/models/sfwmm/

10.3.2 MIKE SHE

http://www.dhi.dk/mikeshe/

11 Appendix 1: Abstracts of Compiled Literature

Below are results from a literature search conducted through the University of Florida library system. Duplicate entries have, for the most part, been removed. Also removed were results that did not directly pertain to modeling of surface water/ground water interactions.

Cambridge Scientific Abstracts
Database: Environmental Sciences and Pollution Mgmt
Query: kw= aquifer and (stream or river or lake) and interaction
Your Comments: from CSA, Database: Environmental Sciences and Pollution Mgmt all records

Record 1 of 153

TI: Title
Variably Saturated Flow Between Streams and Aquifers
AU: Author
Peterson, DM; Wilson, JL
AF: Author Affiliation
New Mexico Inst. of Mining and Technology Socorro. Dept. of Geoscience
SO: Source
Available from National Technical Information Service, Springfield VA 22161 as PB89-148506/AS, price codes: A10 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report No. 233, September 1988. 289p, 57 fig, 5 tab, 120 ref, append. USGS state project 1345628.
AB: Abstract
The influence of unsaturated media on stream infiltration has been examined through a series of numerical solutions of combined saturated-unsaturated (variably saturated) flow in simple stream-aquifer systems. System behavior is analyzed largely in terms of response to declines in local water table level, presumably as a result of increased pumping on a regional basis. The simulations, all of which are of a generic nature, are roughly based on existing and possible future conditions in the Mesilla Valley portion of the lower Rio Grande Valley in south-central New Mexico. Emphasis is placed on cases in which a zone of unsaturated material lies between the stream and the underlying water table. Under this set of conditions, the stream and aquifer are described as being disconnected. Factors that strongly affect the disconnection process include streambed clogging by fine-grained materials and aquifer heterogeneity. When disconnected, a stream aquifer system with a shallow water table behaves quite differently from one in which the water table is deep. Differences between these two cases, as well as with other stream-aquifer situations, are distinctly manifested in hydraulic head and moisture content distributions, pressure head profiles, system fluxes and water table behavior. (USGS)
PY: Publication Year
1988
DE: Descriptors
Groundwater; Stream-aquifer interaction; Aerationzone; Groundwater

recharge; Variably saturated flow; Model studies; Simulation analysis; Steady state analysis; Transient analysis; Water table level; New Mexico; Mesilla Valley
CL: Classification
SW 0840 Groundwater; SW 0845 Water in soils; SW 2040 Groundwater management
SF: Subfile
Water Resources Abstracts
AN: Accession Number
8908434

Record 2 of 153

TI: Title
Stream-Aquifer Interaction
AU: Author
Liggett, JA
AF: Author Affiliation
Cornell Univ. Ithaca, NY. Dept. of Environmental Engineering
SO: Source
Available from the National Technical Information Service, Springfield VA 22161, as PB87-207130/AS. Price codes: A04 in paper copy, A01 in microfiche. New York Water Resources Research Institute, Ithaca. Technical Completion Report, August 1984. 35 p, 5 fig, 23 ref. Contract No. 14-08-0001-G859. Project No. USGS G859-02.
AB: Abstract
The specific objective of the research was to develop a better understanding and methodology of computing the interaction of groundwater and surface waters, and to quantify, through computer analysis, the interaction between the time varying flow in the stream, the rise and fall of the groundwater level, and the flow between the two. A simple model (the Muskingum routing method) was chosen for the streamflow routing to reduce the complexity of the program since the primary focus was on groundwater. A standard boundary element method was used for the groundwater calculation. The computational mesh is automatically generated by the program using the channel data and the depth and distance to the free surface of the aquifer. The hydraulic conductivity and effective porosity of the aquifer complete the necessary specifications. This project demonstrated that computer programs do not need to be large and complex. The program developed uses less than ten lines of data, excluding hydrograph data, for a simple case and runs rapidly; it can be run on a microcomputer. The program represents a platform on which can be constructed a hierarchy of increasingly complex models. (USGS)
PY: Publication Year
1984
DE: Descriptors
New York; Computer models; Stream-aquifer interaction; Groundwater; Surface-groundwater relationships; Computer programs; Routing; Streamflow
CL: Classification
SW 0810 General; SW 0840 Groundwater
SF: Subfile
Water Resources Abstracts
AN: Accession Number
8800743

Record 4 of 153

TI: Title
An Ephemeral Stream-Aquifer Interaction Model
AU: Author

Dillon, PJ; Liggett, JA
AF: Author Affiliation
Adelaide Univ. (Australia). Dept. of Civil Engineering
SO: Source
Water Resources Research Vol. 19, No. 3 p 621-626, June, 1983. 13 Fig, 13 Ref. NSF grant CEE-7902803.
AB: Abstract
The boundary integral equation method is applied to the interaction between an ephemeral stream and an unconfined aquifer through a semipervious streambed. The resulting two-dimensional vertical slice model describes groundwater flow when the stream and aquifer are hydraulically disconnected or connected as well as the transition between these two states. It incorporates the Green-Ampt equation with the hydraulically disconnected boundary conditions. The model was successfully calibrated using stream discharge and bore hydrograph data from the Little Para River recharge study, South Australia. It predicts with sufficient accuracy the inflow and outflow from the stream to the aquifer during fluctuating water levels in the stream. (Author 's abstract)
PY: Publication Year
1983
DE: Descriptors
Ephemeral streams; Aquifers; Hydraulic models; Streambeds; Groundwater movement; Water level fluctuations; Mathematical models; Green-Ampt equation; Boundary conditions; Boundary integral equation; Stream discharge; Australia; Little Para River
CL: Classification
SW 0810 General
SF: Subfile
Water Resources Abstracts
AN: Accession Number
8401704

Record 5 of 153

TI: Title
Regional Water Resources Simulation with Stream Aquifer Interaction, Sensitivity Analysis and Inverse Modelling
AU: Author
Chaturvedi, MC; Ramakrishna, CV
AF: Author Affiliation
Indian Inst. of Tech. New Delhi
SO: Source
Ground Water in Water Resources Planning IAHS Publication No. 142, 1983. Volume II: Proceedings of a Symposium, Koblenz, West Germany, August 28-September 3, 1983. p 735-763, 14 fig, 14 ref.
AB: Abstract
Regional ground-water simulation for the Upper Yamuna Basin in India, covering an area of about 11,500 sq km from the Himalayas to Delhi, was carried out in the context of policy and systems studies. A finite element model was developed. The issue of flux generation through inverse modelling and stream-aquifer interaction were specifically developed. The basin, developmental issues, and data base are briefly described. The basin was discretized with 207 elements which were quadratic-isoparametric with varying dimensions. Each element had eight nodes, viz. four corner nodes and four mid-side nodes to give a total of 688 nodes. Calibration was done for 100 nodes and typical results are given. Sensitivity analysis for several parameters was carried out in terms of three statistical bases. Inverse modelling on basis of control theoretic approach has been developed and is also presented. (See also W86-05679) (Author 's abstract)
PY: Publication Year

1983
DE: Descriptors
Inverse modeling; Groundwater simulation; Model studies; Sensitivity analysis; Surface-groundwater relations; Water resources development; Aquifers; Yamuna Basin; India; Delhi; River basins; Mathematical studies
CL: Classification
SW 0840 Groundwater; SW 2040 Groundwater management
SF: Subfile
Water Resources Abstracts
AN: Accession Number
8605696

Record 6 of 153

TI: Title
Improved modelling of the groundwater processes in HYDROLOG
AU: Author
Chiew, FHS; McMahon, TA
AF: Author Affiliation
Univ of Melbourne, Aust
CF: Conference
International Hydrology and Water Resources Symposium 1991 Part 2 (of 3), Perth, Aust, 10/02-04/91
SO: Source
NATL CONF PUBL INST ENG AUST, IE AUST, BARTON, (AUST), 1991, vol. 2, no. 91 pt 22, pp. 492-497
IS: ISSN
0313-6922
PB: Publisher
IE AUST, BARTON, (AUST)
AB: Abstract
This paper describes an improved representation of the groundwater processes in the daily rainfall-runoff model, HYDROLOG. The simulation of the stream-aquifer interaction was modified to include the modelling of the flow from the river to the aquifer and the simulation of the deep seepage process was modified to allow possible movement of water from the deep aquifer to the shallow aquifer. Comparison of the river recharge and baseflow rates estimated by the 'modified HYDROLOG' model (MODHYDROLOG) with those simulated by an integrated surface and groundwater model indicated that the improved algorithms provide a better representation of the groundwater processes than the algorithms that are currently used.
LA: Language
English
PY: Publication Year
1991
PT: Publication Type
Book Monograph; Conference
DE: Descriptors
Flow of Water--Underground; Rain and Rainfall--Mathematical Models; Runoff--Mathematical Models
ID: Identifiers
Groundwater Processes; HYDROLOG Rainfall-Runoff Model; Stream-Aquifer Interaction; Deep Seepage
CL: Classification
EE 444 Water Resources; EE 471 Marine Science and Oceanography; EE 631 Fluid Flow; EE 921 Applied Mathematics; EE 443 Meteorology
SF: Subfile
Environmental Engineering Abstracts
AN: Accession Number
0122627

Record 7 of 153

TI: Title
Field assessment of stream/aquifer interaction under semi-arid conditions and problems with computer representation

AU: Author
Bissett, LL; Poeter, EP

SO: Source
COLORADO WATER RESOURCES RESEARCH INSTITUTE, COLORADO STATE UNIVERSITY, FORT COLLINS, CO 80523 (USA), 1994, 95 pp
NT: Notes
Completion Report No: 185.
PB: Publisher
COLORADO WATER RESOURCES RESEARCH INSTITUTE, COLORADO STATE UNIVERSITY, FORT COLLINS, CO 80523 (USA)

AB: Abstract
As the population increases and technological development grows in Colorado, problems with the appropriation of water are becoming more serious and common. Surface water rights are particularly difficult to obtain, so groundwater is becoming especially important to newcomers and entities with junior water rights. The relationship of groundwater use to stream discharge is well known, but difficult to quantify. Groundwater models have attempted to address the problem, but while some promising new codes have been developed, they have not been adequately tested and are not generally used. A field area in Golden, Colorado containing a small, ephemeral stream was studied with the aim of specifying problems associated with the modeling codes used in the area of stream/aquifer interaction. Field data describing the streamflow, streambed hydraulic conductivity, aquifer hydraulic conductivity and aquifer hydraulic heads were available, and data regarding streambed and aquifer geometries were collected. The scale and types of data collected were chosen to obtain information regarding flow and gradients across and surrounding the stream boundary. This information was used to construct and calibrate a MODFLOW groundwater flow model. MODFLOW mathematically models a three dimensional area in steady state or transient modes. The area is discretized into a three dimensional grid to which boundary conditions are set on all sides. Each grid cell is assigned parameter values. The model calculates the hydraulic head and the flow into and out of each grid cell. The Streamflow Routing Package was used as the stream module in MODFLOW. This package is more an accounting program, tracking the flow in streams interacting with the groundwater, than a true surface-water flow model. It allows the user to specify the stream stage or to have the code determine the stream stage. This second option is an improvement on the original MODFLOW river module. The original module used constant stream stages; it calculated the seepage between the groundwater system and the stream, but did not allow the stream stage to vary in response to seepage.

LA: Language
English
PY: Publication Year
1994
PT: Publication Type
Report
DE: Descriptors
streams; aquifers; surface-groundwater relations; semiarid lands; computers; water rights; hydrologic data collections; model studies; stage measurement; streamflow; flow measurement; USA, Colorado, Golden
CL: Classification
SW 0810 General; SW 0835 Streamflow and runoff; SW 0840 Groundwater

SF: Subfile
Water Resources Abstracts
AN: Accession Number
3745009

Record 8 of 153

TI: Title
Accounting for Intracell Flow in Models with Emphasis on Water Table Recharge and Stream-Aquifer Interaction: II. A Procedure
AU: Author
Jorgensen, DG; Signor, DC; Imes, JI
AF: Author Affiliation
Geological Survey Denver, CO
SO: Source
Water Resources Research WRERAO Vol. 25, No. 4, p 677-684, April 1989. 5 fig, 14 ref.
AB: Abstract
Intercepted intracell flow, especially if the cell includes water table recharge and a stream (sink), can result in significant model error if not accounted for. A procedure utilizing net flow per cell (Fn) that accounts for intercepted intracell flow can be used for both steady state and transient simulations. Germane to the procedure is the determination of the ratio of area of influence of the interior sink to the area of the cell (Ai/Ac). Ai is the area in which water table recharge has the potential to be intercepted by the sink. Determining Ai/Ac requires either a detailed water table map or observation of stream conditions within the cell. A proportioning parameter M, which is equal to 1 or slightly less and is a function of cell geometry, is used to determine how much of the water that has potential for interception is intercepted by the sink within the cell. Also germane to the procedure is the determination of the flow across the streambed (Fs), which is not directly a function of cell size, due to difference in head between the water level in the stream and the potentiometric surface of the aquifer underlying the streambed. The use of Fn for steady state simulations allows simulation of water levels without utilizing head-dependent or constant head boundary conditions which tend to constrain the model-calculated water levels, an undesirable result if a comparison of measured and calculated water levels is being made. Transient simulations of streams usually utilize a head-dependent boundary condition and a leakance value to model a stream. Leakance values for each model cell can be determined from a steady state simulation, which used the net flow per cell procedure. For transient simulation, Fn would not include Fc. Also, for transient simulation it is necessary to check Fn at different time intervals because M and Ai/Ac are not constant and change with time. The procedure was used successfully in two different models of the aquifer system in the Ozarks. The use of Fn was essential to the two model studies because most model cells in both models contained water table recharge and multiple sinks. (See also W89-09890) (Author 's abstract)
PY: Publication Year
1989
DE: Descriptors
Hydrologic models; Surface-groundwater relations; Model studies; Groundwater recharge; Recharge; Water table; Streams; Aquifers; Precipitation
CL: Classification
SW 0840 Groundwater; SW 0835 Streamflow and runoff; SW 0810 General
SF: Subfile
Water Resources Abstracts

AN: Accession Number
8909891

Record 9 of 153

TI: Title
A Coupled Surface-Water and Ground-Water Flow Model for Simulation of Stream-Aquifer Interaction
AU: Author
Swain, ED; Wexler, EJ
SO: Source
Available from Books and Open File Report Section, USGS, Box 25425, Denver, CO 80225. USGS Open-File Report 92-138, 1992. 162p, 30 fig, 3 tab, 17 ref. Project No. FL494.
AB: Abstract
This report describes a new, coupled groundwater and surface water model that was developed by combining U.S. Geological Survey models MODFLOW and BRANCH. MODFLOW is the widely used modular three-dimensional, finite-difference groundwater model and BRANCH is a one-dimensional, numerical model commonly used to simulate unsteady flow in open-channel networks. MODFLOW was originally written with a 'River' package, which calculates leakage between aquifer and streams, assuming that stream stages remain constant over one model stress period. A simple streamflow routing model has recently been added to MODFLOW, but its use is limited to simulating conditions of steady flow in rectangular, prismatic channels. In this study, the more versatile BRANCH model was restricted and incorporated along with the groundwater model MODFLOW into a package called MODBRANCH. Terms that describe leakage between a stream and an aquifer as a function of streambed conductance and difference in head between the aquifer and the stream were added to the continuity equation in BRANCH. The BRANCH model calculates new stream stages based on upstream boundary conditions, stream properties, and initial estimates of aquifer heads. Aquifer heads are then calculated in MODFLOW based on stream stages calculated by BRANCH, aquifer properties, and stresses. This process is repeated until convergence criteria are met for head and stage. Because time steps used in groundwater modeling can be much longer than time intervals used in surface water simulations, provision has been made for handling multiple BRANCH time intervals within one MODFLOW time step. An option was added to BRANCH to allow the simulation of channel drying and rewetting. Verification testing of the coupled model was done using data from previous studies and by comparing results with output from a simpler, four-point implicit, open-channel flow model linked with MODFLOW. (USGS) 35 057449001
PY: Publication Year
1992
DE: Descriptors
*Computer programs; *Hydrologic models; *Mathematical models; *Model studies; *Surface-groundwater relations; Aquifers; Hydrologic systems; Simulation; Stream leakage
CL: Classification
SW 5080 Evaluation, processing and publication; SW 0835 Streamflow and runoff; SW 0840 Groundwater
SF: Subfile
Water Resources Abstracts
AN: Accession Number
9308596

Record 10 of 153

TI: Title
Stream-aquifer interaction models: A review.

AU: Author
Dillon, PJ
AF: Author Affiliation
Dep. Civil Eng., Univ. Adelaide, Australia
SO: Source
TRANS. INST. ENG. AUSTRAL. CIVIL ENG., vol. CE-25, no. 2, pp. 107-113, 1983
AB: Abstract
The assumptions upon which models of stream-aquifer interaction are based are examined. This provides a starting point to compare model performance for the large variety of existing models including integrated stream-aquifer models.
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1983
PT: Publication Type
Journal Article
DE: Descriptors
streams; aquifers; mathematical models; dispersion; fluid mechanics
CL: Classification
P 2000 FRESHWATER POLLUTION
SF: Subfile
Pollution Abstracts
AN: Accession Number
0636918

Record 11 of 153

TI: Title
Accounting for Intracell Flow in Models with Emphasis on Water Table Recharge and Stream-Aquifer Interaction: I. Problems and Concepts
AU: Author
Jorgensen, DG; Signor, DC; Imes, JI
AF: Author Affiliation
Geological Survey Denver, CO
SO: Source
Water Resources Research WRERAO Vol. 25, No. 4, p 669-676, April 1989. 5 fig, 25 ref.
AB: Abstract
Intracell flow is important in modeling cells that contain both sources and sinks. Special attention is needed if recharge through the water table is a source. One method of modeling multiple sources and sinks is to determine the net recharge per cell. For example, for a model cell containing both a sink and recharge through the water table, the amount of recharge should be reduced by the ratio of the area of influence of the sink within the cell to the area of the cell. The reduction is the intercepted portion of the recharge. In a multilayer model this amount is further reduced by a proportion factor, which is a function of the depth of the flowlines from the water table boundary to the internal sink. A gaining section of a stream is a typical sink. The aquifer contribution to a gaining stream can be conceptualized as having two parts: the first part is the intercepted lateral flow from the water table and the second is the flow across the stream bed due to differences in head between the water level in the stream and the aquifer below. The amount intercepted is a function of the geometry of the cell, but the amount due to difference in head across the stream bed is largely independent of cell geometry. A discharging well can intercept recharge through the water table

within a model cell. The net recharge to the cell would be reduced in proportion to the area of influence of the well within the cell. The area of influence generally changes with time. Thus the amount of intercepted recharge and net recharge may not be constant with time. During periods when the well is not discharging there will be no intercepted recharge even though the area of influence from previous pumping may still exist. The reduction of net recharge per cell due to internal interception of flow will result in a model-calculated mass balance less than the prototype. Additionally the effective transmissivity along the intercell flow paths may be altered when flow paths are occupied by intercepted recharge. (See also W89-09891) (Author 's abstract)

PY: Publication Year
1989

DE: Descriptors
Hydrologic models; Surface-groundwater relations; Model studies; Groundwater recharge; Recharge; Water table; Streams; Aquifers; Precipitation

CL: Classification
SW 0840 Groundwater; SW 0835 Streamflow and runoff; SW 0810 General

SF: Subfile
Water Resources Abstracts

AN: Accession Number
8909890

Record 13 of 153

TI: Title
Stream-aquifer interaction model with diffusive wave routing

AU: Author
Perkins, SP; Koussis, AD

AF: Author Affiliation
Kansas Geol. Surv., Univ. Kansas, 1930 Constant Ave., Lawrence, KS 66047, USA

SO: Source
Journal of Hydraulic Engineering [J. HYDRAUL. ENG.], vol. 122, no. 4, pp. 210-219, 1996

IS: ISSN
0733-9429

AB: Abstract
A practical approach to modeling the hydraulic interaction of a stream and aquifer via streambed leakage is based on the established U.S. Geological Survey (USGS) model, MODFLOW. To represent flood-wave propagation and the associated bank storage, MODFLOW's STREAM module is replaced by the Muskingum-Cunge diffusive-wave-routing scheme. The diffusive wave model closely approximates a dynamic model of a flood wave's speed, shape, and streambed leakage. Because the stream responds more rapidly to disturbances than the aquifer, streambed leakage is calculated at the flood routing time scale in order to properly represent the stream-aquifer coupling. However, both the relative magnitude and timing of aquifer response to a flood wave depend on the strength of this coupling. We find discrepancies in both the flood wave and the streambed leakage when the wave and ground-water motions are evaluated at different time scales. These discrepancies are significant in the case of a strong stream-aquifer coupling, for which equal aquifer and flood-routing time steps may be required. Wave diffusion and bank storage are shown to be comparable in magnitude and should, therefore, be included in stream-aquifer interaction models. Diffusive wave routing more accurately represents wave propagation, bed leakage, and aquifer response if short aquifer time steps are taken, and is preferable to the STREAM module for simulating short time transients. However, the

STREAM module is useful for simulating large time frames if accurate modeling of the flood-wave propagation is not required.
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1996
PT: Publication Type
Journal Article
DE: Descriptors
surface-groundwater relations; hydrologic models; streambeds; leakage; flood waves; bank storage; flood routing; aquifers; timing
ID: Identifiers
MODFLOW; STREAM module
CL: Classification
SW 0810 General; SW 0840 Groundwater
SF: Subfile
Water Resources Abstracts
AN: Accession Number
3935501

Record 14 of 153

TI: Title
Ground- and surface-water interaction between the Kansas River and associated alluvial aquifer, northeastern Kansas
AU: Author
Wolf, RJ; Helgesen, JO
SO: Source
U.S. GEOLOGICAL SURVEY, BOOKS AND OPEN-FILE REPORTS SECTION, FEDERAL CENTER, BOX 25425, DENVER, CO 80225, 1993, 49 pp
PB: Publisher
U.S. GEOLOGICAL SURVEY, BOOKS AND OPEN-FILE REPORTS SECTION, FEDERAL CENTER, BOX 25425, DENVER, CO 80225
AB: Abstract
Water in the Kansas River valley alluvial aquifer between Wamego and Topeka, Kansas, has been intensively developed without a general decline of water levels. To evaluate the stream-aquifer system and the effects of ground-water development, a finite-element model was used to simulate transient flow and water-level conditions for the 40-year period, 1948-87, and to implement 8-year hypothetical simulations of below-average, near-average, and above-average streamflow and precipitation. Model calibration for the aquifer involved both spatial and temporal comparisons of measured and simulated water levels until a satisfactory match was achieved. Calibration of the streamflow component of the model consisted of comparisons of measured and simulated monthly discharge of the Kansas River at the stream-gaging station at Topeka. The simulated discharge generally agreed with the measured discharge. Average recharge to the aquifer from 1948 to 1987 resulting from deep percolation of precipitation and applied irrigation water simulated by the model was about 84 ft super(3)/s (cubic feet per second). Lateral inflow was about 7 ft super(3)/s. Simulated average discharge from the aquifer was about 42 ft super(3)/s for pumpage, 27 ft super(3)/s for net stream-aquifer leakage to the main stem Kansas River, 15 ft super(3)/s for discharge to tributaries, 9 ft super(3)/s for ground-water evapotranspiration, and 3 ft super(3)/s for downgradient lateral outflow. Simulated recharge to the aquifer from all sources averaged about 98 ft super(3)/s for the 1948-87 period. Simulated discharge averaged about 96 ft super(3)/s during that period; thus, the volume of water in storage increased at an

average rate of about 2 ft super(3)/s. Yearly water-level variations reflect precipitation variations, and the average water-level rise across the area during the 40-year simulation period was about 4 feet. Results of simulated yearly mean net stream-aquifer leakage during 1948-87 indicated that the aquifer generally discharged to the stream.
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1993
PT: Publication Type
Report
DE: Descriptors
alluvial aquifers; surface-groundwater relations; land development; streamflow; precipitation; groundwater recharge; water level; stream discharge; USA, Kansas
CL: Classification
SW 0810 General
SF: Subfile
Water Resources Abstracts
AN: Accession Number
3644199

Record 15 of 153

TI: Title
Groundwater-Surface Water Interaction at Topaz Lake, Nevada
AU: Author
Price, DR; Wheatcraft, SW; Jacobson, RL; Bruce, LP
AF: Author Affiliation
Nevada Univ. System Reno. Desert Research Inst
SO: Source
Available from the National Technical Information Service, Springfield VA 22161 as PB83-256776, Price codes: A07 in paper copy, A01 in microfiche. Publication No. 41085, August 1983. 130 p, 24 Fig, 8 Tab, 42 Ref. 2 Append. OWRT B-111-NEV(1), 14-34-0001-9121.
AB: Abstract
A hydrologic study was conducted to investigate groundwater-lakewater interactions around Topaz Lake, Nevada, where an alluvial aquifer is hydraulically connected with the off-stream storage reservoir. Basic objectives of the study were: 1) the estimation of aquifer characteristics; 2) the estimation of recharge to the aquifer from the surrounding mountains; 3) the determination of the flux between the aquifer and the lake; and 4) the potential for contamination of the lake or groundwater from the other. While the lake was increasing in storage, aquifer recharge was determined to be 62% from the mountains and 38% from the reservoir substantiating the potential for impact on the aquifer by the reservoir. Groundwater seepage to the reservoir represented only one percent of its total volume, thus, degradation of the reservoir by groundwater is small.
PY: Publication Year
1983
DE: Descriptors
Lake stages; Water level fluctuations; Bank storage; Surface-groundwater reactions; Nevada; Aquifer characteristics; Lake shores; Water chemistry; Seepage; Groundwater movement; Topaz Lake; Recharge; Groundwater recharge
CL: Classification
SW 0840 Groundwater
SF: Subfile

Water Resources Abstracts
AN: Accession Number
8303920

Record 16 of 153

TI: Title
Surface- and Ground-Water Interaction and Hydrologic Budget of the Missouri River Valley Aquifer between Yankton South Dakota, and St. Louis, Missouri
AU: Author
Jorgensen, DG; Hedman, ER
AF: Author Affiliation
Geological Survey
SO: Source
Available from Books and Open File Reports Section, USGS Box 25425, Denver, CO 80225. USGS Atlas HA-721, 1990. 1p, 3 fig, 2 tab, 1 map, 9 ref.
AB: Abstract
The thickness and width of the Missouri River Valley aquifer differ greatly in the study reaches of the Missouri River; thickness of the aquifer ranges from > 50 ft to < 300 ft, and the width ranges from about 4 mi to > 15 mi. Analysis of the elements of the hydrologic budget indicates that the Missouri River Valley aquifer gains water in five of the reaches and loses water in five others. The Missouri River Valley aquifer is in hydraulic connection with three regional geohydrologic units (Great Plains Aquifer system in the upstream reaches, Western Interior Plains confining system in the middle reaches, and Ozark Plateaus aquifer system in the downstream reaches). The gains and losses in flow are related to the regional geohydrology and, therefore, are assumed to be due to interaction between the Missouri River-Missouri River Valley aquifer and the regional geohydrologic units rather than other unevaluated sources or sinks. Gains and losses in the 10 reaches ranged from -908 to +1,219 cu ft/sec; however, the accuracy of the calculated gains and losses can not be fully ascertained. (Lantz-PTT)
PY: Publication Year
1990
DE: Descriptors
Aquifer systems Aquifers Groundwater budget Groundwater; resources Hydrologic maps Maps Mississippi-Missouri River Basin; Surface-groundwater relations Geohydrology Hydrologic budget; Missouri South Dakota
CL: Classification
SW 0810 General; SW 0840 Groundwater
SF: Subfile
Water Resources Abstracts
AN: Accession Number
9104856

Record 17 of 153

TI: Title
Modeling transient stream/aquifer interaction with the non-linear Boussinesq equation and its analytical solution
AU: Author
Serrano, SE; Workman, SR
AF: Author Affiliation
Department of Civil Engineering, University of Kentucky, Lexington, KY 40506, USA
SO: Source
Journal of Hydrology (Amsterdam) [J. Hydrol. (Amst.)], vol. 206, no. 3-4, pp. 245-255, May 1998

IS: ISSN
0022-1694
AB: Abstract
A new analytical solution of the non-linear transient groundwater flow equation subject to time variable river boundaries was used to simulate stream/aquifer interactions in an alluvial valley aquifer. The differential equations were solved using the method of decomposition. The mathematical model required relatively few parameters to simulate groundwater elevations: hydraulic conductivity, specific yield, and recharge. The model was physically based and could simulate the process of a flood wave propagation into an unconfined aquifer. The model was tested using observed water table elevations at three locations across a 2 km wide alluvial valley aquifer. The average daily deviation between observed and simulated water table elevations was approximately 0.09 m. The transient redistribution of water in the aquifer was simulated well with the model. The non-linear form of the Boussinesq equation was shown to better simulate cases when the transmissivity of the aquifer could not be assumed to be a constant.
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1998
PD: Publication Date
19980500
PT: Publication Type
Journal Article
DE: Descriptors
Surface-groundwater Relations; Streams; Aquifers; Alluvial Deposits; Groundwater Movement; Permeability Coefficient; Water Table; Transmissivity; Estimating Equations; Ground water; Surface water; Rivers
ID: Identifiers
Boussinesq equations; aquifer properties
TR: ASFA Input Center Number
CS9820871
CL: Classification
SW 0810 General; Q2 02171 Dynamics of lakes and rivers
UD: Update
199810
SF: Subfile
Water Resources Abstracts; ASFA 2: Ocean Technology Policy & Non-Living Resources
AN: Accession Number
4367815

Record 18 of 153

TI: Title
Aquifer characteristics derived from the interaction between water levels of a terminal lake (Dead Sea) and an adjacent aquifer
AU: Author
Yechieli, Y; Ronen, D; Berkowitz, B; Dershowitz, WS; Hadad, A
AF: Author Affiliation
Geological Survey of Israel, Jerusalem, Israel
SO: Source
Water Resources Research [WATER RESOUR. RES.], vol. 31, no. 4, pp. 893-902, 1995
IS: ISSN
0043-1397
LA: Language

English
SL: Summary Language
English
PY: Publication Year
1995
PT: Publication Type
Journal Article
DE: Descriptors
aquifer characteristics; water level; lakes; surface-groundwater relations; saline water; flow; closed basins; closed lakes; Israel, Dead Sea; water levels; lake dynamics; lake basins
ER: Environmental Regime
Brackish
TR: ASFA Input Center Number
CS9700101
CL: Classification
SW 0810 General; Q2 02167 Tides, surges and sea level
SF: Subfile
Water Resources Abstracts; ASFA 2: Ocean Technology Policy & Non-Living Resources
AN: Accession Number
3972736

Record 19 of 153

TI: Title
Interaction of Lake Michigan with a layered aquifer stressed by drainage
AU: Author
Cherkauer, DS; Carlson, DA
AF: Author Affiliation
Dep. Geosciences, Univ. Wisconsin-Milwaukee, P.O. Box 413, Milwaukee, WI 53201, USA
SO: Source
Ground Water [GROUND WATER], vol. 35, no. 6, pp. 981-989, Dec 1997
IS: ISSN
0017-467X
NT: Notes
Contact: Ground Water Publishing Co., 6375 Riverside Dr., Dublin, OH 43017 (USA). PH: (800) 332-2104. FAX: (614) 761-3446.
AB: Abstract
Ground-water interaction with lakes is often difficult to document because of both its diffusiveness and its spatial and temporal variability; reproducible measurements can he difficult to obtain. This paper takes advantage of the construction of a major drain stress in an aquifer system proximal to Lake Michigan to examine ground-water/lake interactions in a complex hydrogeological setting. At the time of the measurements, the tunnel (4 to 8 m in diameter, 13 km in length, 1 to 3 km inland, and constructed in a low conductivity unit within a layered, fractured dolomite aquifer) had produced drawdowns of up to 50 m in the aquifer. In turn, the resulting trough of depression was inducing over 1600 m super(3)/day (425,000 gpd) of water to flow from the lake to the tunnel. Seepage meters have been deployed over 40 km super(2) of the lake bed to define the extent of the tunnel's impact. The results show that seepage through the lake bed is a combination of downward flow toward the tunnel and lateral inflow generated by recharge events in shallow unconsolidated sediments. Downward seepage is detectable to more than 2 km offshore, so an average of over 20 m of clay-rich glacial deposits and 10 m of dolomitic shale (both with hydraulic conductivities < 3 x 10 super(-8) m/sec) does not isolate the lake from the aquifer. Seepage meters have proven to be a viable and cost-effective means to provide an accurate spatial distribution of ground-water/lake exchanges over

a large area.
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1997
PD: Publication Date
19971200
PT: Publication Type
Journal Article
DE: Descriptors
USA, Michigan L.; Surface-groundwater Relations; Aquifer Systems; Tunnels; Seepage; Spatial Distribution; Subsurface Drainage; Stress; Drawdown; Ground water; Hydrology; USA, Michigan L.
ER: Environmental Regime
Freshwater
TR: ASFA Input Center Number
CS9801778
CL: Classification
SW 0810 General; SW 0840 Groundwater; Q2 02171 Dynamics of lakes and rivers
UD: Update
199802
SF: Subfile
Water Resources Abstracts; ASFA 2: Ocean Technology Policy & Non-Living Resources
AN: Accession Number
4228143

Record 20 of 153

TI: Title
Quantifying Groundwater Storage and Interaction in a Multi-Layered Alluvial Aquifer
AU: Author
Naney, JW; Kent, DC; Hemann, MR; Neafus, R
AF: Author Affiliation
Agricultural Research Service Durant, OK
SO: Source
Second International Conference on Groundwater Quality Research: Proceedings, National Center for Groundwater Research, Houston TX. (1985). p 199-202, 4 fig, 2 tab, 6 ref.
AB: Abstract
Comparisons are made between total penetration wells and those completed in selected layers of the Washita River alluvium near Anadarko, Oklahoma in order to determine the effects of layered lithology on aquifer yield. The hydraulic characteristics developed from analysis of core samples from individual sand and silt layers within the alluvium are used to estimate groundwater storage and movement within the alluvium. Pumping tests of a nearby total penetration irrigation well and those from research test wells are compared in order to relate yield determined by analytical techniques to that of a producing well. Aquifer test results are presented for wells in specific layers. A unique relationship between the D50 grain size and the permeability within each layer is demonstrated which makes it feasible to use the laboratory test, rather than the more expensive pumping test to determine permeability. The results of the multi-layered and homogeneous cases are compared using a map of transmissivity residuals which indicates areas of reduced storage within nearly 70,000 acres of aquifer during a 20 year period of simulated pumping in the Washita River alluvium. (Author 's abstract)
PY: Publication Year

1985
DE: Descriptors
Groundwater storage; Alluvial aquifers; Hydraulic properties; Hydrology; Wells; Irrigation wells; Aquifers; Pumping tests; Washita River; Anadarko; Oklahoma
CL: Classification
SW 0840 Groundwater
SF: Subfile
Water Resources Abstracts
AN: Accession Number
8604096

Record 22 of 153

TI: Title
Interaction Between Groundwater and Surface Water Regimes and Mining-Induced Acid Mine Drainage in the Stockett-Sand Coulee Coal Field
AU: Author
Osborne, TJ; Donovan, JJ; Sonderegger, JL
AF: Author Affiliation
Montana Coll. of Mineral Science and Technology Butte
SO: Source
Montana Water Resources Research Center Report No. 138, Bozeman June 1983. 215 p, 9 Fig, 4 Tab, 25 Ref, 5 Append. Project No. OWRT A-129-MONT (1), Contract/Grant No. 14-34-0001-1128, 14-34-0001-2128.
AB: Abstract
Abandoned underground coal mines in the Stockett and Sand Coulele, Montana, region have been discharging acid water for many years, causing severe pollution of Sand Coulee Creek and tributaries, and groundwater resources. A two-year investigation of the hydrogeology of the Sand Coulee Creek basin was conducted to formulate acid mine drainage mitigation techniques based on hydrologic systems controls and decentralized neutralization. Periodic field inventories in 1980-83 located at least 17 acid discharge points flowing either perennially or ephemerally. The measured total rate of acid discharge ranged from 1 to 3.3 cu ft/sec. Most acid discharges were of very poor quality with field pH ranging from 2.2 to 5.4, acidity from 108 to 6002 mg/l as CaCo3 and specific conductance from 1038 to 15,966 microsiemens per centimeter. Water types were mostly ferrous-aluminum sulfate with dissolved iron concentrations from 12 to 1065 mg/l. Acid water comprises roughly 60-90% of the baseflow of Sand Coulee Creek. Most baseflow is lost to evapotranspiration and subsurface seepage. Most alluvial groundwater is polluted and has not been utilized by residents for many years. Vertical groundwater gradients are primarily downward, and mine drainage water reaches lower bedrock aquifers through stream seepage, alluvial groundwater leakage and well bore leakage. Proposed mitigation techniques included infiltration control through cultivation of water consumptive crops and grain recropping in recharge areas, vertical connector wells or horizontal wells to dewater the Kootenai aquifer overlying the old coal mines, injection and neutralization of acid water in the Madison limestone, and small-scale neutralization pits using flyash and alkaline Kootenai groundwater.
PY: Publication Year
1983
DE: Descriptors
Coal mine water; Acid mine water; Mine drainage; Surface-groundwater relationships; Montana; Water pollution sources; Infiltration; Hydrogeology; Water types; Flyash; Infiltration control; Acid neutralization; Madison aquifer;

Kootenai aquifer
CL: Classification
SW 3020 Sources and fate of pollution; SW 3070 Water quality control
SF: Subfile
Water Resources Abstracts
AN: Accession Number
8500583

Record 23 of 153

TI: Title
Recharge in Semiarid Mountain Environments
AU: Author
Gross, GW
AF: Author Affiliation
New Mexico Inst. of Mining and Technology Socorro
SO: Source
Available from the National Technical Information Service, Springfield VA 22161 as PB83-173286, Price codes: A03 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute Report No 153, Las Cruces, June 1982. 36 p, 8 Fig, 23 Ref. OWRT B-059-NMEX(3), 14-34-0001 9123.
AB: Abstract
A systematic investigation of tritium activity in precipitation, surface water, springs, and ground water of the Roswell artesian basin in New Mexico, has been supplemented by hydrogeologic reconnaissance of spring systems; by various statistical correlations and spectral analysis of stream flow and water level records of observation wells; by spring discharge measurements; by stable isotope determinations (oxygen 18 and deuterium); and by numerical modeling of part of the basin. Two recharge contributions to the Principal or Carbonate Aquifer have been distinguished principally on the basis of their tritium label and aquifer response characteristics. A ' fast ' recharge component, of relatively high tritium activity, consists of snowmelt and storm runoff and enters the ground water system mostly as leakage from surface drainages where these cross the karstic San Andres Formation. A ' slow ' recharge component, low in tritium, is transmitted from the western mountains through formations underlying the San Andres. Near the western basin edge, this ' slow ' component, in the form of springs and shallow ground water, also feeds effluent streams which, in turn, lose most of it to the San Andres aquifer where they cross karstic zones. Almost all basin waters (including deep ground water) fall close to the meteoric line of hydrogen/oxygen isotope composition, and this rules out a juvenile origin or appreciable bedrock interaction.
PY: Publication Year
1982
DE: Descriptors
Groundwater; Recharge; Tritium; Oxygen 18; Deuterium; Computer models; Artesian aquifer; New Mexico; Isotype studies; Springflow; Precipitation; Isotope hydrology; Groundwater/surface water interaction; Roswell artesian basin
CL: Classification
SW 0840 Groundwater; SW 0835 Streamflow and runoff
SF: Subfile
Water Resources Abstracts
AN: Accession Number
8302137

Record 24 of 153

TI: Title

Flow Processes and Data Provision for Channel Flow Models
AU: Author
Bathurst, JC
AF: Author Affiliation
Newcastle upon Tyne Univ. (England). Dept. of Civil Engineering
SO: Source
Modelling Geomorphological Systems. John Wiley and Sons New York. 1988. p 127-152, 6 fig, 1 tab, 84 ref.
AB: Abstract
The past two decades have seen the development of powerful channel flow models capable of integrating main channel flow with overbank flow, aquifer interaction, and the transport of sediments, pollutants, and heat. Much of the emphasis has been on numerical solution techniques, which have advanced to a level where they are no longer the principal limiting factor in model application. Data provision methodologies are not generally capable of supplying the large amounts of data required to develop and calibrate the models. In addition, not all models incorporate a sufficient understanding of the relevant field processes. Channel processes such as secondary circulation, effects of tributary inflows, overbank flow, meandering channels , dambreak floods, floodplain flow resistance, and stream-aquifer interaction are not always adequately addressed by channel flow models. Transport models are flow models coupled with equations describing the transport of sediment, pollutants, or heat. Data requirements for transport models include many channel features subject to wide spatial and temporal variation, and data collection is hampered by the relatively unsophisticated measurement methods currently available. Improvements in model applications will require advances in data provision and the understanding and mathematical description of relevant channel processes. (See also W90-10334) (Tappert-PTT)
PY: Publication Year
1988
DE: Descriptors
Channel flow; Geomorphology; Model studies; Sediment transport; Alluvial rivers; Bed load; Channel erosion; Channel morphology; Data interpretation; Finite difference methods; Flow characteristics; Mathematical equations; Mathematical models; Mathematical studies; River beds; Sedimentation
CL: Classification
SW 0870 Erosion and sedimentation; SW 0835 Streamflow and runoff
SF: Subfile
Water Resources Abstracts
AN: Accession Number
9010340

Record 25 of 153

TI: Title
Fiscal Year 1985 Program Report (Wyoming Water Research Center)
AU: Author
Bergman, HL
AF: Author Affiliation
Wyoming Water Research Center Laramie
SO: Source
Available from the National Technical Information Service, Springfield VA 22161, as PB87-165924/AS. Price codes: A03 in paper copy, A01 in microfiche. Program Report G-1054-01. August 1986. 36 p, 4 tab, 2 fig. Contract No. 14-08-0001-G1054. Project No. USGS G1054-01.
AB: Abstract
Three research projects were funded under the FY 1985 program which covered topic areas in water quality problems in which

organic contaminant transport between groundwater and surface waters was considered, recreational problems in which the effects of reservoir eutrophication on recreational activities and values is being assessed, and groundwater recharge through stream-aquifer interaction along fault zones. Information transfer was done principally through a symposium on Wyoming water problems, extension activities, mailings on available publications through a newsletter and participation at several meetings held by groups in the State of Wyoming on water issues. A field study on the movement of organic contaminants through groundwaters to surface streams created by a wood-treating facility and an oil refinery indicated that oily seeps occur into the surface stream and adversely affect the biological activity in the stream. Use of ambient toxicity tests were found to be sensitive enough to detect migration of contaminated groundwater into surface streams. A recreational based valuation method was developed and sample tested to estimate the effects of change in water quality due to eutrophication of a reservoir on recreational benefits and uses. The method used sampled recreationalists on direct and indirect contact at the reservoir site with a follow-up questionnaire. The sample data indicate a change in user recreational activities due to eutrophication. A field study is being conducted to investigate stream-aquifer interaction phenomena in fracture permeable Paleozoic rock outcrops. Using streamflow discharge measurements above and below the fracture permeable rock outcrop areas along with well level measurements, quantification of recharge due to streamflow during the entire year has shown that the groundwater system is being recharged directly from the stream at different rates during different times of the year. (Bergman-WY Water Res. Cr.)
PY: Publication Year
1986
DE: Descriptors
Water Research Institute; Research; Information transfer; Training; Wyoming; Water quality; Organic contaminants; Groundwater; Surface water; Sediments; Eutrophication; Recreation; Economic benefits; Natural recharge; Stream discharges; Effluent streams
CL: Classification
SW 7080 Grants, contracts and research act allotments
SF: Subfile
Water Resources Abstracts
AN: Accession Number
8803183

Record 26 of 153

TI: Title
Field Study of Ephemeral Stream-Aquifer Interaction
AU: Author
Cox, WB; Stephens, DB
AF: Author Affiliation
New Mexico Inst. of Mining and Technology Socorro. Dept. of Geoscience
SO: Source
Proceedings of the FOCUS Conference on Southwestern Ground Water Issues. National Water Well Association, Dublin OH. 1988. p 337-358, 11 fig, 7 ref.
AB: Abstract
Ephemeral streams, the Rio Puerco and Rio Salado, north of Socorro, NM, near Interstate-25 were instrumented to investigate infiltration and groundwater recharge due to channel seepage. Monitor wells, neutron access holes and stream stage recorders provided information to characterize the nature of stream aquifer

interaction and to quantify recharge. The Rio Puerco has a relatively well-defined channel with a small width to depth ratio. The Rio Puerco flows in response to both winter and summer precipitation, as well as spring runoff. The stream carries a large suspended sediment load which results in the development of a clogging layer on the channel bottom. The Rio Salado has a large width-depth ratio and a braided channel filled mostly with permeable sand and gravel. The Rio Salado flows mostly in the summer in response to thunderstorms. The results show that hydraulic connection to the underlying aquifer is highly variable on the Rio Puerco. For the Rio Salado, hydraulic connection during streamflow is highly dependent on depth to groundwater and localized channel characteristics. THe results are relevant to conceptual models of stream-aquifer interaction, calculated channel and canal losses, and numerical modeling of flow and solute transport in groundwater systems. (See also W89-02331) (Author's abstract)

PY: Publication Year
1988

DE: Descriptors
Ephemeral streams; Surface-groundwater relations; New Mexico; Rio Puerco; Rio Salada; Infiltration; Groundwater recharge; Groundwater monitoring; Monitoring wells; Aquifers; Model studies; Hydrology; Geohydrology; Seasonal variation; Alluvial channels

CL: Classification
SW 0840 Groundwater; SW 0810 General; SW 0835 Streamflow and runoff

SF: Subfile
Water Resources Abstracts

AN: Accession Number
8902349

Record 28 of 153

TI: Title
A River Basin Network Model for Conjunctive Use of Surface and Groundwater: Program CONSIM

AU: Author
Labadie, JW; Phamwon, S; Lazaro, RC

AF: Author Affiliation
Colorado State Univ. Fort Collins. Dept. of Civil Engineering

SO: Source
Available from the National Technical Information Service, Springfield VA 22161 as PB83-235291, Price codes: A07 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute Completion Report No 125, Colorado State University, Fort Collins, June 1983. 134 p, 30 Fig, 6 Tab, 40 Ref. OWRT B-201-COLO(5), 14-34-0001-9061.

AB: Abstract
A generalized planning model has been constructed which simulates the dynamics of a complex river basin system. This model uses a network approach which is capable of modeling systems with a large-scale and complex water storage, transport, and distribution morphology. The model, called Program CONSIM, is also capable of considering stream-aquifer interaction, including the effects of pumping and artificial recharge on a monthly or weekly basis. Potential evaporation is computed directly in the model by the Blaney-Criddle method, but other methods can be selected by the user and input as demands in the model. Complex institutional factors such as formal water rights and informal exchange agreements can also be considered. The model as designed can be used for locating and sizing new facilities (e.g., reservoirs), impacts of transfer of water rights, incorporating new demands for energy development, instream uses, transbasin diversions,

conjunctive use of surface and groundwater, and contingency planning for potential drought periods. The computer model has been especially designed to be interactive and conversational for ease of use by planners and managers.
PY: Publication Year
1983
DE: Descriptors
River basins; Simulation; Optimization; Conjunctive use; Reservoir operation; Computer programs; Groundwater; Model studies; Program CONSIM
CL: Classification
SW 4010 Techniques of planning; SW 2040 Groundwater management
SF: Subfile
Water Resources Abstracts
AN: Accession Number
8303596

Record 29 of 153

TI: Title
Field Study of Ephemeral Stream Infiltration and Recharge
AU: Author
Stephens, DB
AF: Author Affiliation
New Mexico Inst. of Mining and Technology Socorro. Dept. of Geoscience
SO: Source
Available from National Technical Information Service, Springfield VA 22161 as PB89-115554/AS, price codes: A09 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report No. 228, January 1988. 187p, 24 fig, 12 tab, 31 ref, 6 append. USGS contract 14-08-0001-G1241. USGS state project 1423658. USGS project G1241-06.
AB: Abstract
Two ephemeral streams north of Socorro, NM, the Rio Puerco and Rio Salado, have been instrumented for the purpose of analyzing groundwater recharge due to channel seepage. Monitor wells and neutron logging wells provided information necessary to characterize the nature of stream aquifer interaction. Groundwater recharge was computed using concolution and other techniques. The Rio Puerco has relatively well-defined, straight channel with a small width-depth ratio and flows in response to both summer and winter precipitation, as well as spring runoff. The stream carries a large suspended sediment load which results in fine-textured sediments on the channel bottom. Although the water table is only about 1m below the channel, the stream and aquifer are not fully hydraulically connected at all times, owing to the development of a low-permeable clogging layer on the channel bottom. The Rio Salado is an ephemeral stream which has a very large width-depth ratio and a braided channel filled mostly with permeable sand and gravel. The Rio Salado flows mostly in the summer in response to thunderstorms. Prior to runoff the depth to groundwater below the channel is about 1m at the upper site and 9m at the lower site. Monitoring the water table elevations and moisture content indicates that during runoff the stream and aquifer are fully hydraulically connected at the upper site but not at the lower site. (Stephens-NM Inst. Mining and Tech.)
PY: Publication Year
1988
DE: Descriptors
Surface-groundwater relations; Groundwater recharge; Aquifers; Streamflow; Infiltration; New Mexico; Rio Puerco; Rio Salado; Monitoring; Seepage; Monitoring wells; Neutron logging wells
CL: Classification

SW 0840 Groundwater; SW 2040 Groundwater management
SF: Subfile
Water Resources Abstracts
AN: Accession Number
8908341

Record 30 of 153

TI: Title
Fiscal Year 1986 Program Report (Wyoming Water Research Center)
AU: Author
Bergman, HL
AF: Author Affiliation
Wyoming Univ. Laramie. Water Resources Research Inst
SO: Source
Available from the National Technical Information Service, Springfield VA 22161, as PB88-175963/AS. Price codes: A04 in paper copy; A01 in microfiche. Program Report G1262-01, July 1987. 45p, 4 tab, 2 fig. Project No. USGS G1262-01. Contract No. 14-08-0001-G1262.
AB: Abstract
Four research projects were funded under the FY 1986 program which included: (1) a field study on the movement of organic contaminants through groundwater to surface streams created by a wood-treating facility and an oil refinery 's NPDES discharge indicated that oily seeps or surface discharges can occur into the surface stream and adversely affect the biological activity in the stream. Use of EPA ambient toxicity tests were found to be sensitive enough to detect migration of contaminated surface or groundwater into surface streams; (2) a recreational based valuation method was developed and tested to estimate the effects of change in water quality due to eutrophication of a reservoir on recreational benefits and uses. The method used sampled recreationalists on direct and indirect contact at the reservoir site with a follow-up questionnaire. The data indicated a change in some users recreational activities due to eutrophication; (3) a field study is being conducted to investigate stream-aquifer interaction phenomena in fracture permeable Paleozoic rock outcrops. Using streamflow discharge measurements above and below the fracture permeable rock outcrop areas along with well level measurements, quantification of recharge due to streamflow during the entire year has shown that the groundwater system is being recharged directly from the stream at different rates during different times of the year; and (4) a study was undertaken to investigate the applicability of crop yield-water use models on crops (winter wheat) grown in high altitude locations (Wyoming). The FAO yield-water use model by Doorenbos and Kassam was found to predict actual yield of winter wheat as a function of maximum yield, a crop response factor and the evapotranspiration ration with fairly good reliability considering that agronomic and soil unknowns were not present in the prediction. Information transfer was done principally through a symposium proceedings on Wyoming water problems, extension activities, mailings on available publications, through a newsletter, and participation at several meetings held by groups in the State of Wyoming or water issues. (Bergman-WY U., WWRC)
PY: Publication Year
1987
DE: Descriptors
Water Research Institute; Research; Information transfer; Training; Wyoming; Water quality; Organic contaminant; Groundwater; Surface water; Sediment; Eutrophication; Recreation; Economic benefits; Natural recharge; Stream discharge; Effluent streams; Crop yield; Water use; Crop production;

Evapotranspiration; Water use efficiency
CL: Classification
SW 7080 Grants, contracts and research act allotments
SF: Subfile
Water Resources Abstracts
AN: Accession Number
8902479

Record 31 of 153

TI: Title
Interaction Between Yazoo River and Mississippi River Valley Alluvial Aquifer System
AU: Author
Cooey, J
SO: Source
Proceedings, Twentieth Mississippi Water Resources Conference, April 10-11, 1990. Jackson, Mississippi. Water Resources Research Institute, Mississippi State University, Mississippi State, Mississippi 39762. 1990. p 122-126, 2 fig, 8 ref.
AB: Abstract
The Yazoo River, located in the Mississippi River Delta in northwest Mississippi, meanders southwestward over part of the Mississippi River Alluvial Plain to join the Mississippi River at Vicksburg, Mississippi. A study was performed to understand the changes in historical and present hydrologic interactions between the waters of the Yazoo River and Mississippi River Alluvial Aquifer System through analysis of all directly-related data, and to propose the best method for measurement and quantification of actual stream-aquifer boundary conditions. Analysis of recession and low flow were accomplished through recession analysis methods. It was shown that down-cutting and lateral movement by the Yazoo River under natural conditions before 1950 insured continual contact between the sands associated with the alluvial aquifer system and the stream, continually changing the hydraulic boundary between the Yazoo River and the Mississippi River Alluvial Aquifer system. Since 1950, the Yazoo River have approached a more constant yearly flow rate due to flood control structures. Analysis of the recession of 97-days under natural conditions and the 44-day recession under regulated conditions indicate a possible change in the river-aquifer hydraulic boundary. Under natural flow conditions recession analysis is a fairly accurate method for measurement of groundwater recharge into a stream during recession. Once a stream flow is controlled, however, the method actually becomes suspect. Other more direct measurement methods must be used to quantify the stream-aquifer hydraulic boundary. (See also W91-05137) (Fish-PTT)
PY: Publication Year
1990
DE: Descriptors
Alluvial aquifers Dam effects Geohydrologic boundaries; Mississippi Recession curve Surface-groundwater relations Yazoo; River Boundary conditions Flow control Groundwater recharge; Hydraulic permeability Natural flow Statistical methods
CL: Classification
SW 0840 Groundwater; SW 0835 Streamflow and runoff
SF: Subfile
Water Resources Abstracts
AN: Accession Number
9105152

Record 32 of 153

TI: Title

Definition of a Capture Zone for Shallow Water Table Lakes
AU: Author
Townley, LR; Davidson, MR
AF: Author Affiliation
Western Australia Univ. Nedlands. Centre for Water Research
SO: Source
Journal of Hydrology JHYDA7 Vol. 104, No. 1-4, p 53-76, December 30, 1988. 12 fig, 24 ref, append.
AB: Abstract
Lake-aquifer interaction was studied to develop simple relationships between easily measurable geometrical and aquifer parameters and the bulk behavior of the flow system. Attention was focused on shallow flow-through lakes which receive groundwater along the up-gradient shoreline and discharge lake water along the down-gradient shoreline. Although the flow system is physically three-dimensional, two idealized two-dimensional geometries, in plan and in vertical section, were studied in detail. The resulting potential flow problems were solved using a boundary integral approach, based on a Green 's function chosen to satisfy desired homogeneous boundary conditions on a semi-infinite strip. Results are presented for circular and elliptical lakes in plan and for lakes so shallow that they are adequately represented in vertical section by a line at the surface. The size of an upstream capture zone, in which all groundwater flow eventually passes through the body of the lake, is defined in terms of the size of the lake, inter-lake spacing, aquifer saturated thickness, an anisotropy ratio, and the ratio of downstream to upstream hydraulic gradients. Even in cases where the net groundwater inflow to a lake is zero, it is shown that a substantial throughflow can occur. (Author 's abstract)
PY: Publication Year
1988
DE: Descriptors
Lakes; Capture zone; Aquifers; Flow system; Surface-groundwater relations; Shores; Boundary conditions; Lake morphology; Anisotropy; Groundwater movement; Hydraulic gradient
CL: Classification
SW 0810 General; SW 0840 Groundwater
SF: Subfile
Water Resources Abstracts
AN: Accession Number
8908112

Record 33 of 153

TI: Title
Development and application of an analytical model of stream/aquifer interaction
AU: Author
Workman, SR; Serrano, SE; Liberty, K
AF: Author Affiliation
Department of Biosystems and Agricultural Engineering, 105 Agricultural Engineering Building, University of Kentucky, Lexington, KY 40546, USA
SO: Source
Journal of Hydrology (Amsterdam) [J. Hydrol. (Amst.)], vol. 200, no. 1-4, pp. 149-163, 15 Dec 1997
IS: ISSN
0022-1694
AB: Abstract
A mathematical model to simulate stream/aquifer interactions in an unconfined aquifer subjected to time varying river stage was developed from the linearized Boussinesq equation using the principle of superposition and the concept of semigroups. The

mathematical model requires an estimate of three parameters to simulate ground-water elevations; transmissivity, specific yield, and recharge. The solution has physical significance and includes terms for the steady-state water level, the steady-state water level as influenced by a change in river stage, a transient redistribution of water levels in the aquifer from the previous day, and a transient change in water level caused by a change in river stage. The mathematical model was tested using observed water table elevations at three locations across a 2-km-wide alluvial valley aquifer. The average absolute deviation between observed and simulated daily water levels was 0.09 m. The difference in river stage over the test year was 4.9 m.

LA: Language
English
SL: Summary Language
English
PY: Publication Year
1997
PD: Publication Date
19971215
PT: Publication Type
Journal Article
DE: Descriptors
Surface-groundwater Relations; Mathematical Models; Water Level; Simulation; Specific Yield; Transmissivity; Water Table Fluctuations; Groundwater Recharge; Ground water; Rivers; Water levels; Hydrodynamic equations
ID: Identifiers
Mathematical models
ER: Environmental Regime
Freshwater
TR: ASFA Input Center Number
CS9805888
CL: Classification
SW 0810 General; SW 0840 Groundwater; Q2 02171 Dynamics of lakes and rivers
UD: Update
199809
SF: Subfile
Water Resources Abstracts; ASFA 2: Ocean Technology Policy & Non-Living Resources
AN: Accession Number
4261249

Record 34 of 153

TI: Title
Saline groundwater inflow to the Darling River near Bourke New South Wales
AU: Author
Williams, RM
AF: Author Affiliation
Dep of Water Resources, New South Wales, Aust
CF: Conference
The Water Down Under 1994 Conference. Part 1 (of 3), Adelaide, Aust, 11/21-25/94
SO: Source
NATL CONF PUBL INST ENG AUST, IE AUST, CROWS NEST, NSW, (AUST), 1994, vol. 1, no. 94/10, pp. 625-628,
IS: ISSN
0313-6922
PB: Publisher
IE AUST, CROWS NEST, NSW, (AUST)
AB: Abstract

Springs have been reported in the Darling River in the vicinity of Bourke from the early 1800's. The River is unregulated but is normally enclosed by a fresh water aureole. Recent work has indicated that saline springs, which puncture the aureole are concentrated along a short reach of the River downstream of Bourke due to geological control. The stream/aquifer interaction is dynamic such that the salt input to the River varies significantly with stream stage and flow duration.

LA: Language
English
PY: Publication Year
1994
PT: Publication Type
Book Monograph; Conference
DE: Descriptors
Saline water; Rivers; Springs (water); Geology; Flow interactions; Aquifers; Hazards; Irrigation; Algae; Hydrology
ID: Identifiers
Saline groundwater inflow; Fresh water aureole; Geological control; Flow duration; Floodplain; Alluvial aquifers; Hydrogeology
CL: Classification
EE 631.2 Hydrodynamics; EE 444.1 Surface Water; EE 481.1 Geology; EE 444.2 Groundwater; EE 461.9 Biology
SF: Subfile
Environmental Engineering Abstracts
AN: Accession Number
0158175

Record 35 of 153

TI: Title
Experimental Studies in Stream-Aquifer Interaction Along the Arkansas River in Central Kansas: Field Testing and Analysis
AU: Author
Sophocleous, M; Townsend, MA; Vogler, LD; McClain, TJ; Marks, ET
AF: Author Affiliation
Kansas State Geological Survey Lawrence
SO: Source
Journal of Hydrology JHYDA7 Vol. 98, No. 3/4, p 249-273, April 15, 1988. 24 fig, 2 tab, 20 ref.
AB: Abstract
During the last several years, streamflows of a number of Kansas streams have been reduced as a result of groundwater declines. In order to better understand and quantify stream-aquifer interrelationships, an eight-day comprehensive stream-aquifer pumping test, followed by recovery monitoring, was conducted along the Arkansas River near Great Bend, Kansas. In addition to water level monitoring in numerous observation wells, streamflow data, streambed hydraulic gradients, neutron-probe based water content of dewatered sediments, water chemistry, and other data were collected. The alluvial aquifer is shown to be highly transmissive (T = 1803 sq m/d) with the pumping stress (9538 cu m/d) having a radius of influence larger than 1.77 km, impacting both the aquifer levels and the streamflow in the nearby Arkansas River. Drawdown and recharge boundary effects were observed in all observation wells, including those on the opposite side of the river. The alluvial aquifer did not exhibit a water table behavior and responded as a leaky confined aquifer. A semiconfining clay layer less than 3 cm thick and an additional recharge source from a nearby stream-alluvial system were the probable cause of the observed phenomena. Actual streamflow depletion is shown to be appreciably less than the computed depletion based on analytical solutions. (Author 's abstract)

PY: Publication Year
1988
DE: Descriptors
Groundwater movement; Aquifers; Drawdown; Recharge; Streamflow; Surface-groundwater relations; Streamflow depletion; Aquifer characteristics; Mathematical Analysis; Confined Aquifers; Leaky Arkansas River; Aquifers; Observation Wells; Kansas; Pumping tests. Aquifers; Depletion
CL: Classification
SW 2040 Groundwater management; SW 0840 Groundwater; SW 0835 Streamflow and runoff
SF: Subfile
Water Resources Abstracts
AN: Accession Number
8809976

Record 36 of 153

TI: Title
Test Holes for Monitoring Surface-Water/Groundwater Relations in the Cottonwood Creek Area, Shasta and Tehama Counties, California, 1984-85
AU: Author
Johnson, MJ; Houston, ER; Neil, JM
AF: Author Affiliation
Geological Survey Sacramento, CA. Water Resources Div
SO: Source
Available from Books and Open File Report Section, USGS Box 25425, Denver, CO 80225; paper copy $5.00, microfiche $4.00. USGS Water-Resources Investigations Report 88-4090, March 1989. 20p, 11 fig, 8 tab, 8 ref.
AB: Abstract
Ten test holes were drilled to obtain hydrogeologic information for an investigation of stream-aquifer interaction near proposed damsites on Cottonwood Creek and South Fork Cottonwood Creek, California. At each site, one deep well was completed below the first confining clay encountered in the upper Tehama Formation to determine hydraulic gradients between water-bearing deposits in the Tehama Formation and overlying channel deposits. At three sites along Cottonwood Creek, two shallow wells were drilled at each site on a line perpendicular to the stream channel to determine if groundwater in channel deposits is moving toward or away from the stream channel and to monitor water levels. Geophysical logs were correlated with lithologic logs compiled from analyses of drill cuttings to determine depths for setting well screens. After pumping to confirm hydraulic connection between each well and the Tehama Formation, water levels were monitored monthly from June 1984 to June 1985; at two sites, water levels were above the altitude of the stream channel bottom during all streamflow conditions. Tritium dating indicates two wells have water more than 100 years old; one well has either a mixture of old and new water or an intermediate-aged water. (USGS)
PY: Publication Year
1989
DE: Descriptors
Tracers; Surface-groundwater relations; Dam construction; Damsites; Cottonwood Creek; California; Water quality; Piezometers; Stable-isotope analysis; Tritium; Deuterium; Shasta County; Tehama County; Dutch Gulch; Olinda; Tehama Formation; Nomlaki Tuff
CL: Classification
SW 0840 Groundwater; SW 2040 Groundwater management; SW 6070 Materials
SF: Subfile

Water Resources Abstracts
AN: Accession Number
8910478

Record 39 of 153

TI: Title
Fiscal Year 1989 Program Report (Kansas Water Resources Research Institute)
AU: Author
Jacobs, HS
AF: Author Affiliation
Kansas Water Resources Research Inst
SO: Source
Available from National Technical Information Service, Springfield, VA 22161 as PB90-273699/AS. Price codes: A03 in paper copy, A01 in microfiche. Program Report G1563-01, May 1990. 19p. USGS Contract No. 14- 08-0001-G1563.
AB: Abstract
The FY 1989 KWRRI research program addressed two priority research concerns in Kansas and includes a total of five projects--four in water quality and one in stream-aquifer interaction. Three projects in water quality were concerned with the impact of constituents in water and included: Leaching of Atrazine and Nitrate through Soil into Groundwater; Microbial Contamination of Surface and Groundwaters Adjacent to Agricultural Enterprises in Kansas; and Denitrification of the Vadose Zone: A Mechanism for Nitrate Removal. A fourth research project in water quality was directed at hydrogeologic characterization of hazardous waste sites. This research focused on predictions of subsurface movement of contaminants in water flow. The study, Stream Floodwave Propagation Through the Great Bend Alluvial Aquifer, demonstrated that water level fluctuations in wells located along paleochannels is correlated with streamflow levels and is a significant recharge mechanisms. A total of 6 undergraduate, 9 Masters, and 3 Ph. D. degree candidates participated in the 1989 program. (Jacobs-KS St Univ, KWWRI)
PY: Publication Year
1990
DE: Descriptors
Information transfer Kansas Research Training Water resources; Institutes Education Projects
CL: Classification
SW 7080 Grants, contracts and research act allotments
SF: Subfile
Water Resources Abstracts
AN: Accession Number
9104895

Record 41 of 153

TI: Title
Automated calibration applied to watershed-scale flow simulations
AU: Author
Yu, Zhongbo; Schwartz, Franklin W
AF: Author Affiliation
Pennsylvania State Univ, University Park, PA, USA
SO: Source
Hydrological Processes [Hydrol Processes], vol. 13, no. 2, pp. 191-209, 15 Feb 1999
IS: ISSN
0885-6087
PB: Publisher

JOHN WILEY & SONS LTD, CHICHESTER, (ENGL)

AB: Abstract
Complexity in simulating the hydrological response in large watersheds over long times has prompted a significant need for procedures for automatic calibration. Such a procedure is implemented in the basin-scale hydrological model (BSHM), a physically based distributed parameter watershed model. BSHM simulates the most important basin-scale hydrological processes, such as overland flow, groundwater flow and stream-aquifer interaction in watersheds. Here, the emphasis is on estimating the groundwater parameters with water levels in wells and groundwater baseflows selected as the calibration targets. The best set of parameters is selected from within plausible ranges of parameters by adjusting the values of hydraulic conductivity, storativity, groundwater recharge and stream bed permeability. The baseflow is determined from stream flow hydrographs by using an empirical scheme validated using a chemical approach to hydrograph separation. Field studies determined that the specific conductance for components of the composite hydrograph were sufficiently unique to make the chemical approach feasible. The method was applied to the Big Darby Creek Watershed, Ohio. The parameter set selected for the groundwater system provides a good fit with the estimated baseflow and observed water well data.

LA: Language
English

PY: Publication Year
1999

PD: Publication Date
19990215

PT: Publication Type
Journal Article

DE: Descriptors
Hydrology; Calibration; Mathematical models; Mixing; Groundwater flow; Hydraulic conductivity

ID: Identifiers
Basin-scale hydrological model (BSHM)

CL: Classification
EE 444.1 Surface Water; EE 943 Mechanical and Miscellaneous Measuring Instruments; EE 921 Applied Mathematics; EE 802.3 Chemical Operations; EE 444.2 Groundwater; EE 631.1 Fluid Flow (General)

UD: Update
199907

SF: Subfile
Environmental Engineering Abstracts

AN: Accession Number
0392687

Record 42 of 153

TI: Title
Fiscal year 1989 program report: Kansas Water Resources Research Institute.

AU: Author
Jacobs, HS

CA: Corporate Author
Kansas Water Resources Inst., Manhattan (USA)

SO: Source
REP. U.S. GEOL. SURV. WATER RESOUR. DIV., 1990, 25 pp

NT: Notes
NTIS Order No.: PB90-273699/GAR.

NU: Other Numbers
USGS/G-1563-01

AB: Abstract

The FY 1989 Kansas Water Resources Research Institute research program addressed two priority research concerns in Kansas and includes a total of five projects -- four in water quality and one in stream-aquifer interaction. Three projects in water quality were concerned with the impact of constituents in water and included: Leaching of atrazine and nitrate through soil into groundwater; Microbial contamination of surface and groundwaters adjacent to agricultural enterprises in Kansas; and Denitrification of the vadose zone: A mechanism for nitrate removal. A fourth research project in water quality was directed at hydrogeologic characterization of hazardous waste sites. (Contract DI-14-08-0001-G1563. Sponsored by Geological Survey, Reston, VA. Water Resources Div.)

LA: Language
English

SL: Summary Language
English

PY: Publication Year
1990

PT: Publication Type
Report

DE: Descriptors
research institutions; water resources; annual reports; USA, Kansas

ID: Identifiers
research programmes; Kansas Water Resour. Res. Inst.

CL: Classification
Q1 01102 Institutes and organizations; Q2 02102 Institutes and organizations; Q5 01501 General

SF: Subfile
ASFA 1: Biological Sciences & Living Resources; ASFA 2: Ocean Technology Policy & Non-Living Resources; ASFA 3: Aquatic Pollution & Environmental Quality

AN: Accession Number
2407084

Record 43 of 153

TI: Title
Documentation of a Computer Program (StreamLink) to Represent Direct-Flow Connections in a Coupled Ground-Water and Surface-Water Model

AU: Author
Swain, ED

SO: Source
Available from Books and Open File Report Section, USGS, Box 25425, Denver, CO 80225. USGS Water-Resources Investigations Report 93-4011, 1993. 62p, 25 fig 1 tab, 9 ref. Project No. F1534.

AB: Abstract
The MODFLOW finite-difference groundwater flow model has been coupled with three surface water packages--the River, Streams, and MODBRANCH packages--to simulate surface flow and its interaction with groundwater. The River package was developed to simulate leakage between the aquifer and the river with a constant head. The Stream package simulates the leakage and also routes the flow down stream with an optional calculation of river heads by Manning's equation. Finally, the most sophisticated representation of riverflow and aquifer leakage came with the coupling of the unsteady riverflow model BRANCH with the MODFLOW model through the MODBRANCH package. To facilitate wider and more flexible uses of the packages, a computer program, (Streamlink), was developed and added to MODFLOW, allowing direct flows to occur between any of the packages and MODFLOW. These flows can be calculated on the basis of water levels, by a transfer of boundary discharge, or by

simply equating water levels at the interface depending on the individual configuration of each package. Streamlink is especially beneficial when simultaneously using the River, Stream, or MODBRANCH packages or when modeling a river flowing directly into or out of a wetlands in direct connection with the aquifer. (USGS) 35 057449001
PY: Publication Year
1993
DE: Descriptors
*Computer programs; *Groundwater movement; *Model studies; *Surface-groundwater relations; Computer models; Discharge rates; Documentation; Groundwater; Model testing; Recharge; Streamflow; Surface water
CL: Classification
SW 0835 Streamflow and runoff; SW 0840 Groundwater; SW 5080 Evaluation, processing and publication
SF: Subfile
Water Resources Abstracts
AN: Accession Number
9308595

Record 44 of 153

TI: Title
Groundwater dominated rivers
AU: Author
Sear, DA; Armitage, PD; Dawson, FH
AF: Author Affiliation
Univ of Southampton, Southampton, UK
SO: Source
Hydrol Processes, vol. 13, no. 3, pp. 255-276, 28 Feb 1999
IS: ISSN
0885-6087
PB: Publisher
JOHN WILEY & SONS LTD
AB: Abstract
This paper explores the significance of groundwater dominance in the surface water system through a combination of review and an exposition of the general hydrology, ecology and geomorphology of rivers draining the main UK aquifers. Groundwater dominance is shown to vary according to the nature of the aquifer lithology, the mechanism of groundwater:surface water interaction and the scale at which one examines this interaction. Using data derived from a range of studies including the UK Environment Agency River Habitat Survey and the UK Institute of Freshwater Ecology RIVPACS invertebrate database it is shown that the nature of the aquifer and mode of influent discharge strongly control the hydrological and ecological characteristics of the environment but that a specific groundwater ecology or hydrogeomorphology is masked by the overriding controls exerted by aquifer geology and catchment topography. Despite this, it is clear that river systems dominated by groundwater flows have specific hydrological characteristics and management issues that require holistic, multidisciplinary approaches that recognize the significance of groundwater and the nature of the interaction with the surface water environment.
LA: Language
English
PY: Publication Year
1999
PD: Publication Date
19990228
PT: Publication Type
Journal Article
DE: Descriptors

Hydrology; Ecology; Geomorphology; Aquifers; Groundwater; Lithology; Water quality; Watersheds; Discharge (fluid mechanics)
ID: Identifiers
Hydrogeomorphology; Catchments
CL: Classification
EE 444.1 Surface Water; EE 444 Water Resources; EE 454.3 Ecology and Ecosystems; EE 481.1.1 Geomorphology; EE 444.2 Groundwater; EE 481.1 Geology
UD: Update
199908
SF: Subfile
Environmental Engineering Abstracts
AN: Accession Number
0398547

Record 46 of 153

TI: Title
Groundwater Flow in Unsaturated/Saturated Zones
AU: Author
Miracapillo, C; Morel-Seytoux, HJ
AF: Author Affiliation
Colorado State Univ
SO: Source
Appropriate Methodologies for Development and Management of Groundwater Resources in Developing Countries. Volume III. Proceedings of an International Workshop held February 23-March 4, 1989. A. A. Balkema, Rotterdam. 1989. p 91-106, 7 fig, 1 tab, 11 ref.
AB: Abstract
The unsaturated zone plays a crucial role in the hydrologic cycle as the link between surface and groundwater. Though there are many aspects to this interaction, examination of a single aspect, that of aquifer recharge, will illustrate nevertheless most essential elements in the linkage. Typically intermittent streams (wadis) and (artificial) infiltration basins are not in permanent hydraulic connection with the underlying water table aquifer. As water becomes available in the wadi or in the basin, infiltration proceeds. Due to the frequent presence of a clogged layer the water flow below the wadi (or basin) bed is unsaturated. Recharge occurs only after the unsaturated wetting front reaches the water table. On the other hand, long after infiltration has ceased at the soil surface, recharge continues from the unsaturated storage in excess of field capacity, which has accumulated above the water table during the infiltration phase. The three-dimensional character of the flow is rendered by a technique that consists of matching a flow solution in a vertical cross-section with a flow pattern in a horizontal plane. Practical examples illustrate the influence of the parameters on the water table level below the infiltrating area and on the lateral recharge rate into the part of the aquifer which is not overlain by the river or basin bed. Comparison with field observations shows the technique to be accurate, inexpensive, and easy to apply. (See also W91-03178) (Author 's abstract)
PY: Publication Year
1989
DE: Descriptors
Aeration zone Groundwater movement Infiltration Model studies; Surface-groundwater relations Water resources development; Analytical methods Developing countries Flow models Groundwater; management Groundwater recharge Hydrologic models Parametric; hydrology Recharge basins Unconfined aquifers Wadi Water; resources management
CL: Classification

SW 0840 Groundwater; SW 0845 Water in soils
SF: Subfile
Water Resources Abstracts
AN: Accession Number
9103185

Record 48 of 153

TI: Title
Impact of flooding on modelling salt transport processes to streams
AU: Author
Jolly, Ian D; Narayan, Kumar A; Armstrong, Don; Walker, Glen R
AF: Author Affiliation
CSIRO Land and Water, Glen Osmond, Aust
SO: Source
ENVIR MODELL SOFTWARE ENVIR DATA NEWS, vol. 13, no. 1, pp. 87-104, 1998
IS: ISSN
1364-8152
PB: Publisher
ELSEVIER SCI LTD, EXETER, (ENGL)
AB: Abstract
The development of many of the world's arid and semi-arid regions has resulted in the salinization of land and water resources. In these areas, soils and groundwaters are often naturally saline and any disturbance of the delicate hydrological balance results in mobilization of the stored salt. The salt transport mechanisms are often highly complex, the understanding of which necessitates the use of computer modelling in combination with field studies. In this paper the transport of salt between groundwater and streams on the Chowilla floodplain in south-eastern Australia was modelled and compared with available field data. The large salinity contrast between the fresh stream and floodwater and the saline groundwater results in density-dependent flow behaviour, and hence necessitated the use of a variable density flow and solute transport model (SUTRA). The model was applied in cross-section over a 6.1-km-long transect across the floodplain. Time varying boundary conditions were employed at the locations of three streams on the transect to simulate the interaction between the rising and falling streams and the adjacent aquifer during and after floods. The model was used to assess the importance of overbank floods in the transport of salt to floodplain streams by carrying out simulations under various recharge scenarios. The simulations showed that the mixing of floodwater and groundwater within the bank storage adjacent to the streams could predict the observed short-term (<12 months) salt load recessions. In order to predict the observed long-term (12-24 months) salt load recessions, the inclusion of localized recharge during overbank floods is required, as hypothesized by previous field-based studies.
LA: Language
English
PY: Publication Year
1998
PD: Publication Date
19980000
PT: Publication Type
Journal Article
DE: Descriptors
Salts; Groundwater; Stream flow; Aquifers; Floods; Mass transfer; Boundary conditions; Mathematical models; Computer simulation; Computer software
ID: Identifiers

Software package SUTRA; Floodwater
CL: Classification
EE 444 Water Resources; EE 471 Marine Science and Oceanography; EE 804.2 Inorganic Compounds; EE 444.2 Groundwater; EE 631.1 Fluid Flow (General); EE 407.2 Waterways
UD: Update
199812
SF: Subfile
Environmental Engineering Abstracts
AN: Accession Number
0353431

Record 49 of 153

TI: Title
Hydrologic Budget Analysis for the Nile Valley in Egypt
AU: Author
Attia, FAR; Allam, MN; Amer, AW
AF: Author Affiliation
Ministry of Irrigation Cairo (Egypt). Research Inst. for Groundwater
SO: Source
Ground Water GRWAAP Vol. 24, No. 4, p 453-459, July-August 1986. 6 fig, 4 tab, 7 ref.
AB: Abstract
A two-dimensional finite-element model has been adapted to simulate the aquifer underlying the Nile Valley of Egypt. Calibration of the model led to the determination of the interaction between the groundwater and the Nile surface water. The water balance computations indicate that the surface drainage component is about double the component of groundwater seepage to the Nile. The monthly sum of both components (groundwater seepage to the river (Gw) + drainage water disposed in the river (Dr sub v)) was maximum in November (1.02 times 10 to the 9th power cu m) when applied irrigation water is made to satisfy leaching requirements. It was minimum in January (70,000 ,000 cu m) during winter closure. Values of the net groundwater flow to the Nile obtained from the application of the model, were in the range of values obtained from the analytical water budget analyses. Reaches of relatively high and low seepage were more easily identified in the model application. The value of the net annual groundwater seepage to the Nile in the reach Edfu-El Wasta, as obtained in the model, was estimated at about 2.1 times 10 to the 9th power cu m. Adding the values of the groundwater withdrawals and evaporation through the capillary fringe to this amount (4.0, 9.0, and 3.0 times 10 to the 9th power cu m/yr in 1980), the total annual net recharge to the groundwater aquifer in the region amounts to about 3.7 times 10 to the 9th power cu m/yr. The model was considered to adequately represent the groundwater system of the Nile Valley and may be used to forecast the effects of managing the integrated groundwater/surface water system. (Lantz-PTT)
PY: Publication Year
1986
DE: Descriptors
Hydrologic budget; Nile River; Egypt; Mathematical models; Hydrologic models; Surface-groundwater relations; Flow rate; Model studies; Groundwater depletion; Groundwater recharge; Water resources planning; Groundwater management
CL: Classification
SW 0840 Groundwater; SW 2040 Groundwater management
SF: Subfile
Water Resources Abstracts
AN: Accession Number
8606168

Record 50 of 153

TI: Title
Fiscal Year 1988 Program Report (Kansas Water Resources Research Institute)
AU: Author
Jacobs, HS
AF: Author Affiliation
Kansas Water Resources Research Inst. Manhattan
SO: Source
Available from National Technical Information Service, Springfield VA 22161 as PB90-119652/AS. Price codes: A03 in paper copy, A01 in microfiche. Program Report G1563-01, July 1989, (revised Sept. 1989). 26p. USGS Contract 14-08-0001-G1563. USGS Project G1563-01.
AB: Abstract
The FY88 KWRRI research projects addressed priorities in integrated aquifer analysis, water quality, river basin management and stream-aquifer interaction. Projects in integrated aquifer analysis and stream aquifer analysis included: Stream Floodwave Propagation through the Great Bend Alluvial Aquifer: A Significant Recharge and Stream-Aquifer Mechanism; and Hydrogeology of the Dakota Aquifer in Western Kansas. Aquifer characterization is a major objective of the two studies. The project, Development of Empirical Models for the Effects of Cadmium, Lead, Manganese, and Zinc on Resident Biota in the Short Creek-Empire Lake Aquatic System, Cherokee, CO., Kansas, characterized heavy metal effects of mine-waste discharges on stream and lake biota in southeast Kansas. The study, Management of the Kansas River Basin: A Systems Approach, applied the optimization model developed in a previous study to six additional reservoirs. Included are the Marion, Council Grove and John Redmond reservoirs on the Cottonwood-Neosho rivers and the Toronto, Fall River, and Elk City reservoirs on the Verdigris River. A total of six undergraduates, six Masters, and four Ph.D. degree students participated in the 1988 program. (USGS)
PY: Publication Year
1989
DE: Descriptors
Water resources institutes; Kansas; Research; Training; Information transfer; Education; Projects
CL: Classification
SW 7080 Grants, contracts and research act allotments
SF: Subfile
Water Resources Abstracts
AN: Accession Number
9005199

Record 52 of 153

TI: Title
Representation of Flows to Partially Penetrating Rivers Using Groundwater Flow Models
AU: Author
Miles, JC
AF: Author Affiliation
University Coll. Cardiff (Wales). Dept. of Civil and Structural Engineering
SO: Source
Journal of Hydrology JHYDA7 Vol. 82, No. 3/4, p 341-355, December 30, 1985. 9 fig, 20 ref.
AB: Abstract
The numerical simulation of regional groundwater flow using equations which incorporate the Dupuit-Forcheimer assumptions, has

been a well established technique. In many aquifer models it was necessary to represent the interaction between the aquifer and one or more rivers where the latter did not fully penetrate the aquifer. Several techniques however are available for representing such situations. A numerical model which represented flows in the vertical and one horizontal dimension was used to obtain accurate estimates of flows to partially penetrating rivers of various dimensions. These results were then compared with results which utilized the Dupuit-Forcheimer assumptions. Different methods of calculating C were used. Three methods of representing the flows to partially penetrating rivers in regional groundwater flow models have been tested. Two of them gave accurate results for a wide variety of river shapes. The two successful methods have been tested on a practical problem involving the river Worfe (Wales) and gave good results. (Khumbatta-PTT)

PY: Publication Year
1985

DE: Descriptors
Groundwater flow; Surface-groundwater relations; Groundwater flow models; Aquifers; Penetrating rivers; Groundwater movement; Groundwater runoff; Simulation analysis; Wales; River Worfe; Regional analysis; Mathematical analysis

CL: Classification
SW 0840 Groundwater; SW 0835 Streamflow and runoff; SW 0810 General

SF: Subfile
Water Resources Abstracts

AN: Accession Number
8700673

Record 54 of 153

TI: Title
The impact of flooding on modelling salt transport processes to streams

AU: Author
Jolly, ID; Narayan, KA; Armstrong, D; Walker, GR

AF: Author Affiliation
CSIRO Land and Water, PMB 2, Glen Osmond, S.A. 5064, Australia; E-mail: ian.jolly@adl.clw.csiro.au

SO: Source
Environmental Modelling & Software with Environment Data News [Environ. Model. Software Environ. Data News], vol. 13, pp. 87-104, 1998

IS: ISSN
1364-8152

AB: Abstract
The development of many of the world's arid and semi-arid regions has resulted in the salinisation of land and water resources. In these areas, soils and groundwaters are often naturally saline and any disturbance of the delicate hydrological balance results in mobilisation of the stored salt. The salt transport mechanisms are often highly complex, the understanding of which necessitates the use of computer modelling in combination with field studies. In this paper the transport of salt between groundwater and streams on the Chowilla floodplain in south-eastern Australia was modelled and compared with available field data. The large salinity contrast between the fresh stream and floodwater and the saline groundwater results in density-dependent flow behaviour, and hence necessitated the use of a variable density flow and solute transport model (SUTRA). The model was applied in cross-section over a 6.1-km-long transect across the floodplain. Time varying boundary conditions were employed at the locations of three streams on the transect to simulate the interaction between the

rising and falling streams and the adjacent aquifer during and after floods. The model was used to assess the importance of overbank floods in the transport of salt to floodplain streams by carrying out simulations under various recharge scenarios. The simulations showed that the mixing of floodwater and groundwater within the bank storage adjacent to the streams could predict the observed short-term (< 12 months) salt load recessions. In order to predict the observed long-term (12-24 months) salt load recessions, the inclusion of localised recharge during overbank floods is required, as hypothesised by previous field-based studies.

LA: Language
English
SL: Summary Language
English
PY: Publication Year
1998
PD: Publication Date
19980000
PT: Publication Type
Journal Article
DE: Descriptors
Flooding; Solute Transport; Salts; Salinization; Streams; Arid Lands; Groundwater; Computer Models; Transport processes; Flood plains; River basins; Salinity gradients; Saline intrusion; Australia
ER: Environmental Regime
Freshwater
TR: ASFA Input Center Number
CS9906697
CL: Classification
SW 0835 Streamflow and runoff; Q2 02171 Dynamics of lakes and rivers
UD: Update
199903
SF: Subfile
Water Resources Abstracts; ASFA 2: Ocean Technology Policy & Non-Living Resources
AN: Accession Number
4386723

Record 55 of 153

TI: Title
Coupled Three-Dimensional Ground-Water Flow and Lake-Stage Model of Northern Palm Beach County, Florida
AU: Author
Dacey, CA; Erickson, JR; Waddell, RK
AF: Author Affiliation
GeoTrans, Inc , Boulder, CO
SO: Source
Coastal Water Resources. Proceedings of a Symposium held in Wilmington, North Carolina. American Water Resources Association , Bethesda Maryland. 1988. p 411-417, 1 fig, 2 ref.
AB: Abstract
Increased groundwater withdrawals from the surficial aquifer in northern Palm Beach County, Florida have adversely impacted the lake stages of 21 shallow lakes in the Eastpointe Lake system. The interaction between the groundwater system and the lakes was evaluated by incorporating a nonlinear stage-volume relationship into the USGS 's flow code MODFLOW and using the modified 3-dimensional code to model the groundwater/surface water system. Effects of pumping and recharge stresses on lake stage, as well as effects of various well field pumpage scenarios and mitigative

alternatives were evaluated. The active lake stage option was added to MODFLOW by deriving nonlinear stage-volume equations for the lakes. The resulting model was successfully calibrated to observation well data. Three major well fields were identified by the model as adversely impacting the Eastponte Lake system: the Hood, Jupiter and Mecca Farms well fields. Simulations with projected increased pumpages indicated that lake stages would be adversely affected without the implementation of mitigative measures. (See also W90-10584) (Lantz-PTT)
PY: Publication Year
1988
DE: Descriptors
Coastal waters; Eastpointe Lake; Environmental effects; Groundwater management; Model studies; Surface-groundwater relations; Water level; Water resources development; Aquifers; Computer models; Florida; Groundwater mining; Groundwater movement; Lake stages; Shallow water; Well fields; Wells
CL: Classification
SW 0840 Groundwater; SW 0850 Lakes; SW 4070 Ecological impact of water development
SF: Subfile
Water Resources Abstracts
AN: Accession Number
9010616

Record 58 of 153

TI: Title
Simulation of the effects of ground-water withdrawal from a well field adjacent to the Rio Grande, Santa Fe County, New Mexico.
AU: Author
McAda, DP
CA: Corporate Author
Geological Surv., Albuquerque, NM (USA). Water Resources Div.
SO: Source
WATER RESOUR. INVEST. U.S. GEOL. SURV., 1990, 37 pp
NT: Notes
NTIS Order No.: PB91-179853/GAR.
NU: Other Numbers
USGS/WRI-89/4184
AB: Abstract
The report demonstrates the use of a basinwide ground-water flow model to provide estimates of the effect of ground-water withdrawal from wells on flow in nearby rivers. The Buckman well field was selected for the study because of its proximity to major rivers, the existence of a basinwide model that can simulate the interaction between the aquifer and the major rivers, and the availability of detailed pumping records for the well field. The model used in the report was developed for the Santa Fe area of the Espanola Basin by McAda and Wasiolek. (Also available from Supt. of Docs. Prepared in cooperation with Santa Fe Metropolitan Water Board, NM.)
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1990
PT: Publication Type
Report
DE: Descriptors
mathematical models; environmental impact; ground water; water use; river basins; river outflow; USA, New Mexico, Santa Fe Cty.
ER: Environmental Regime

Freshwater
CL: Classification
Q5 01521 Mechanical and natural changes; Q2 02127 General papers on resources
SF: Subfile
ASFA 3: Aquatic Pollution & Environmental Quality; ASFA 2: Ocean Technology Policy & Non-Living Resources
AN: Accession Number
3023369

Record 59 of 153

TI: Title
Soil-aquifer-stream interactions -- a reductionist attempt toward physical-stochastic integration.
AU: Author
Morel-Seytoux, HJ
AF: Author Affiliation
Dep. Civ. Eng., Colorado State Univ., Fort Collins, CO 80523, USA
SO: Source
Journal of Hydrology (Amsterdam) [J. HYDROL. (AMST.).], vol. 102, no. 1-4, pp. 355-379, 1988
IS: ISSN
0022-1694
NT: Notes
Spec. issue: Hydrologic res.: The U.S.-Japan experience
AB: Abstract
This paper illustrates in a simple manner this process of multiple integration for the processes of infiltration, moisture redistribution, aquifer recharge and aquifer return flow, with emphasis on the stream-aquifer interaction. The paper suggests that temporal patterns of rainfall, spacial variation in soil properties, temporal fluctuations in river stage, sharp turns in flow directions (e.g. from vertical to horizontal direction at the interface of two soil layers with contrasting hydraulic properties or in the vicinity of a water table) etc., can significantly affect the response of a watershed. The paper also suggests that simple techniques can be devised that account to a large extent for these influences and will provide satisfactory tools for watershed modeling.
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1988
PT: Publication Type
Journal Article
DE: Descriptors
hydrology; watersheds; modelling; stream flow; flow rates; aquifers; streams; soils
CL: Classification
Q2 02171 Dynamics of lakes and rivers; H SE1.22 LAKE AND RIVER ECOLOGY
SF: Subfile
ASFA 2: Ocean Technology Policy & Non-Living Resources; Health & Safety Science Abstracts
AN: Accession Number
1952317

Record 61 of 153

TI: Title
Solute Transport in a Stream-Aquifer System: 2. Application of

Model Identification to the River Murray
AU: Author
Jakeman, AJ; Dietrich, CR; Thomas, GA
AF: Author Affiliation
Australian National Univ. Canberra. Centre for Resource and Environmental Studies
SO: Source
Water Resources Research WRERAQ Vol. 25, No. 10, p 2177-2185, October 1989. 9 fig, 5 tab, 21 ref.
AB: Abstract
Using a model derived previously for the transport of a conservative solute along a stream connected to an aquifer, the model is applied to a 207-km reach of the River Murray in Australia. The appropriate model structure and its parameter values are determined using principals of system identification. The major tools applied are instrumental variable estimation techniques. The system identification procedure allows a testing of prior assumptions in the derivation of the accession model, determination of the appropriate dynamic model orders, and estimation of associated parameters. The success of the procedure adds support that the processes and assumptions largely apply, and it confirms that the interaction between aquifer and stream is basically linear and dynamic on a daily time scale. It shows that the response of a saline accession to a unit pulse change in the difference of aquifer and river level per unit river discharge is essentially a single exponential decay. The identification statistics prove that adding exponential terms to the series does not lead to increases of more than 1% in the ability to explain saline accession. The parameter estimation also quantifies the steady state salt load per unit stage height as equal to 292 tons/d. Furthermore, the saline accession response to a pulse is such that it takes approximately 4.3 days to decay to 1/3 of the peak of the pulse. (Author 's abstract)
PY: Publication Year
1989
DE: Descriptors
Surface-groundwater relations; Path of pollutants; Solute transport; Groundwater pollution; Stream pollution; Model studies; Aquifers; Salinity; Piezometers
CL: Classification
SW 3020 Sources and fate of pollution; SW 0835 Streamflow and runoff; SW 0840 Groundwater
SF: Subfile
Water Resources Abstracts
AN: Accession Number
9002196

Record 63 of 153

TI: Title
Genesis and Continuity of Quaternary Sand and Gravel in Glacigenic Sediment at a Proposed Low-Level Radioactive Waste Disposal Site in East-Central Illinois
AU: Author
Troost, KG; Curry, BB
SO: Source
Environmental Geology and Water Sciences EGWSEI, Vol. 18, No. 3, p 159-170, November/December 1991. 13 fig, 1 tab, 14 ref.
AB: Abstract
The Illinois Department of Nuclear Safety has characterized the Martinsville Alternative Site (MAS) for a proposed low-level radioactive waste disposal facility. The MAS is located in east-central Illinois approximately 1.6 km (1 m) north of the city of Martinsville. Geologic investigation of the 5.5-sq km

(1380-acre) site revealed a sequence of chiefly Illinoian glacigenic sediments from 6 to 60 m (20-200 ft) thick overlying two major bedrock valleys carved in Pennsylvanian strata. Relatively permeable buried units include basal, preglacial alluvium, a complex of intraglacial and subglacial sediment, englacial deposits, and supra-glacial fluvial deposits. Post-glacial alluvium underlies stream valleys on and adjacent to the site. In most areas, the buried sand units are confined by low-permeability till, lacustrine sediment, colluvium, and loess. The distribution and thickness of the most extensive and continuous buried sand units have been modified considerably by subglacial erosion, and their distributions have been influenced by the buried bedrock valleys. The most continuous of the various sand units were deposited as pre-glacial and post-glacial alluvium and are the uppermost and lowermost stratigraphic units at the alternative site. Sand units that were deposited in englacial or ice-marginal environments are less continuous. Aquifer pumping tests, potentiometric head data , and groundwater geochemistry analyses indicate minimal interaction of groundwater across localized interconnections of the permeable units. (Author's abstract) 35 023904000

PY: Publication Year
1991

DE: Descriptors
*Geohydrology; *Illinois; *Radioactive waste disposal; *Site selection; *Site selection; *Waste disposal; Alluvium; Geochemistry; Geology; Martinsville Alternative Site; On-site investigations; Permeability; Sand

CL: Classification
SW 3050 Ultimate disposal of wastes; SW 3020 Sources and fate of pollution

SF: Subfile
Water Resources Abstracts

AN: Accession Number
9210500

Record 64 of 153

TI: Title
Simulation of regional flow and salinity intrusion in an integrated stream-aquifer system in coastal region: Southwest Region of Bangladesh

AU: Author
Nobi, N; Gupta, ADas

AF: Author Affiliation
Asian Inst of Technology, Klong Luang, Thail

SO: Source
Ground Water [GROUND WATER], vol. 35, no. 5, pp. 786-796, 1997

IS: ISSN
0017-467X

PB: Publisher
GROUND WATER PUBL CO, COLUMBUS, OH, (USA)

AB: Abstract
A numerical model for simulation of the regional flow and salt-water intrustion in an integrated stream-aquifer system in coastal regions is developed, considering the dynamic interaction between the streams and the aquifer. The stream-aquifer model comprised of a two-dimensional depth-average finite-element model of the aquifer system and a quasi-steady node and reach model of the river network. The applicability of the model was demonstrated, through simulation of the spatial and temporal distributions of flow and salinity in the estuaries and in the underlying aquifer of the Southwest Region of Bangladesh. The important management aspects of water transfer and additional

pumping and their effects on the system were evaluated. The interactions between the streams and the aquifer significantly influenced the flow and salt-water intrusion in the aquifer and the river network. An increased abstraction of ground water in the area caused a significant increase in the estuarine salinity. The salinity intrusion in the estuaries of the area, except in the southwest corner, could be reduced significantly by diverting the available water from the Ganges through the boundary river Gorai.
LA: Language
English
PY: Publication Year
1997
PT: Publication Type
Journal Article
DE: Descriptors
Aquifers; Rivers; Stream flow; Groundwater flow; Saline water; Coastal zones; Mathematical models; Finite element method; Estuaries
ID: Identifiers
Stream aquifer systems
CL: Classification
EE 444 Water Resources; EE 444.2 Groundwater; EE 444.1 Surface Water; EE 631.1 Fluid Flow (General); EE 471 Marine Science and Oceanography; EE 921 Applied Mathematics
SF: Subfile
Environmental Engineering Abstracts
AN: Accession Number
0301114

Record 65 of 153

Record 67 of 153

TI: Title
Floodwater recharge processes in the Chowilla/anabranch system, South Australia
AU: Author
Jolly, ID; Walker, GR; Narayan, KA
AF: Author Affiliation
Div. Water Resour. Cent. Groundwater Stud., CSIRO, PMB No. 2, Glen Osmond, S.A. 5064, Australia
SO: Source
Australian Journal of Soil Research [AUST. J. SOIL RES.], vol. 32, no. 3, pp. 417-435, 1994
IS: ISSN
0004-9573
AB: Abstract
The authors report the results of a study into the interaction between floodwaters and an unconfined alluvial aquifer in the Chowilla anabranch system of the River Murray during a large flood. Data on watertable elevation, groundwater chemistry and unsaturated zone salt storage were collected before, during and after a flood in 1990 which inundated all but the very highest points of the floodplain. These data, combined with analytical modelling of the watertable behaviour throughout the flood, led us to conclude that diffuse vertical recharge of floodwater to the unsaturated zone is of little importance. As a consequence, only limited leaching of salt from this zone to the groundwater occurs. This appears to be due to a reduction in the infiltration capacity of the sodic clay surface soils of the floodplain which disperse and swell when wetted with the low salinity floodwater. This suggests that the unsaturated zone is not the major source of salt which enters the River Murray following floods. However, from previous studies it is clear that the floodplain is an important

source of saline groundwater which is added to the river following floods. An alternative hypothesis to explain the observed salt accessions is that areas of the floodplain where the Coonambidgal Clay is thin or absent are zones of localized recharge which cause displacement of in situ groundwater into the floodplain streams. This hypothesis should be tested in further work.
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1994
PT: Publication Type
Journal Article
DE: Descriptors
water table fluctuations; groundwater; leaching; soil water; saturation zone; floodwater; salinity; Australia, South Australia, Murray R.; alluvial aquifers; surface-groundwater relations; flood plains; ground water; water table; floods; rivers; water management; Australia, Murray R.
ER: Environmental Regime
Freshwater
TR: ASFA Input Center Number
CS9501032
CL: Classification
SW 0810 General; Q2 02171 Dynamics of lakes and rivers
SF: Subfile
Water Resources Abstracts; ASFA 2: Ocean Technology Policy & Non-Living Resources
AN: Accession Number
3660288

Record 69 of 153

TI: Title
Groundwater flow model determinations of areal hydrogeology and geology.
AU: Author
Pennequin, DFE
AF: Author Affiliation
Filtres Crepines Johnson S.A., Domine-86530, Naintre, France
SO: Source
Ground Water [GROUND WATER.], vol. 21, no. 5, pp. 552-557, 1983
IS: ISSN
0017-467X
AB: Abstract
The two-dimensional groundwater flow model developed by Trescot et al. was used to determine several important parameters needed to compute the groundwater flow component to and from Lake Wingra, Madision, Wisconsin; these include horizontal hydraulic conductivity, ratio of horizontal hydraulic conductivities between two layers, average anisotropy of the sediments in each layer, and average depth of interaction between a lake and an aquifer. In addition to gaining hydrogeologic information, the model was used successfully to estimate general geologic relationships in part of the northeast shore area of Lake Wingra.
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1983
PT: Publication Type
Journal Article

DE: Descriptors
groundwater; hydraulics; geology; flow rates; mathematical models
CL: Classification
P 2000 FRESHWATER POLLUTION
SF: Subfile
Pollution Abstracts
AN: Accession Number
0619646

Record 71 of 153

TI: Title
Stream-Aquifer Influence Coefficients as Tools for Simulation and Management
AU: Author
Illangasekare, T; Morel-Seytoux, HJ
AF: Author Affiliation
Colorado State Univ. Fort Collins. Engineering Research Center
SO: Source
Water Resources Research Vol 18, No 1, p 168-176, February, 1982. 6 Fig, 42 Ref.
AB: Abstract
The discrete kernel approach for an isolated aquifer is combined with the discrete kernel approach for an isolated stream to derive influence coefficients for a combined stream-aquifer system. The influence coefficients establish explicit relationships between the controllable decision varibles and known initial conditions and the resulting states of the combined system. The aquifer and stream systems are coupled using a linear relation for the aquifer-stream interaction. A hypothetical system is used as an example. The effects of pumping from one or two wells in an aquifer adjoining a river are determined on the aquifer level, the direction of flow between river and aquifer, and the river level in three river reaches. (Cassar-FRC)
PY: Publication Year
1982
DE: Descriptors
Aquifers; Streamflow forecasting; Water management; Surface-groundwater relations; Streams; Pumping; Model studies; Water table; Drawdown; Wells
CL: Classification
SW 0840 Groundwater; SW 0835 Streamflow and runoff
SF: Subfile
Water Resources Abstracts
AN: Accession Number
8205346

Record 72 of 153

TI: Title
Hydrology of a Stream-Aquifer System in the Camp Verde Area, Yavapai County, Arizona
AU: Author
Owen-Joyce, SJ
AF: Author Affiliation
Geological Survey Tucson, AZ. Water Resources Div
SO: Source
Arizona Department of Water Resources Bulletin 3 1984. 60p, 14 fig, 6 tab, 3 plates, 25 ref.
AB: Abstract
A dynamic interaction between the distribution of 30,000 acre-ft of water diverted from the Verde River to irrigate fields on the alluvium and the inflow of above 1,000 acre-ft of water from the under-lying artesian aquifer in the Verde Formation determines the

quantity and quality of water in the alluvium south of Camp Verde, Arizona. About 70% or 21,800 acre-ft of the diverted irrigation water returns to the Verde River as subsurface flow, which with 14,000 acre-ft of water flowing through the alluvium from West Clear Creek to the Verde River flushes the alluvial aquifer. About 9,300 acre-ft of water is lost to evapotranspiration. Groundwater in the alluvium is unconfined and hydraulically connected to the Verde River and Verde Formation. Groundwater inflow to the alluvium from the Verde Formation occurs in areas where the hydraulic head in the Verde Formation is higher than the hydraulic head in the alluvium; wells open to both formations are another path of groundwater inflow. Saturated thickness in the alluvium ranged from 0 to about 30 ft in February to April 1981; the annual minimum amount of water stored in the alluvium occurs prior to irrigation and was estimated to be 17,500 acre-ft. Groundwater for most of the alluvium contained more than the maximum contaminant level for dissolved solids and in some areas contained more than the maximum contaminant levels for sulfate, chloride, and arsenic in public water supplies proposed by the U.S. EPA and the State of Arizona. Dissolved solids concentrations ranged from 251 to 4 ,400 mg/L; 85% of the samples exceeded 500 mg/L. Locally, the presence of reworked Verde Formation deposited in the alluvium causes large concentrations of dissolved solids and sulfate particularly downslope from the salt mine. Ammonia concentrations ranged from 0.01 to 0.25 mg/L; more than 0.1 mg/L generally indicates organic pollution. (Lantz-PTT)
PY: Publication Year
1984
DE: Descriptors
Groundwater management; Groundwater quality; Surface-groundwater relations; Aquifers; Streams; Arizona; Irrigation; Hydrologic studies; Runoff; Evapotranspiration; Groundwater movement; Arsenic; Dissolved solids; Sulfates; Ammonia
CL: Classification
SW 0840 Groundwater; SW 0835 Streamflow and runoff; SW 2040 Groundwater management
SF: Subfile
Water Resources Abstracts
AN: Accession Number
8903773

Record 74 of 153

TI: Title
The threat to river flows from groundwater pumping
AU: Author
Glennon, RJ
AF: Author Affiliation
Coll. Law, Univ. Arizona, Tucson, AZ 85721, USA
SO: Source
Rivers, vol. 5, no. 2, pp. 133-139, 1995
IS: ISSN
0898-8048
AB: Abstract
Understanding the threat to surface flows from groundwater pumping requires some understanding of general principles of hydrogeology (See Glennon and Maddock 1994). Prior to the development of groundwater wells, a groundwater system exists in a state of approximate equilibrium. Discharge of water from the aquifer into rivers and streams roughly equals the recharge of subterranean waters into the aquifer. A complicated interaction exists between rivers and streams and groundwater aquifers. In a "losing" stream, water infiltrates the aquifer from the stream. In a "gaining" stream, water infiltrates the stream from the aquifer. To

oversimplify, most losing streams are situated in areas with the groundwater table, the point below which the ground is entirely saturated, far below the bottom of the river or stream. In contrast, gaining streams tend to be located in areas with a high water table and the saturated ground provides water to the stream. Discharge of water from an aquifer through groundwater pumping imposes a new process on the previously-balanced groundwater system. This discharge produces either a decrease in aquifer storage and/or some combination of an increase in recharge and a decrease in natural discharge. This last aspect should most concern people interested in instream flows.

LA: Language
English
PY: Publication Year
1995
PT: Publication Type
Journal Article
DE: Descriptors
instream flow; pumping; surface-groundwater relations; geohydrology; influent streams; effluent streams; groundwater recharge; water law; aquifer characteristics
CL: Classification
SW 2040 Groundwater management
SF: Subfile
Water Resources Abstracts
AN: Accession Number
3849873

Record 75 of 153

TI: Title
Documentation of a Computer Program to Simulate Stream-Aquifer Relations Using a Modular, Finite-Difference, Ground-Water Flow Model
AU: Author
Prudic, DE
AF: Author Affiliation
Geological Survey Carson City, NV. Water Resources Div
SO: Source
Available from Books and Open Files Report Section USGS Box 25425, Denver, CO 80225. USGS Open-File Report 88-729, 1989. 113p, 16 fig, 2 tab, 6 ref, 3 append.
AB: Abstract
Computer models are widely used to simulate groundwater flow for evaluating and managing the groundwater resource of many aquifers, but few are designed to also account for surface flow in streams. A computer program was written for use in the US Geological Survey modular finite difference groundwater flow model to account for the amount of flow in streams and to simulate the interaction between surface streams and groundwater. The new program is called the Streamflow-Routing Package. The Streamflow-Routing Package is not a true surface water flow model, but rather is an accounting program that tracks the flow in one or more streams which interact with groundwater. The program limits the amount of groundwater recharge to the available streamflow. It permits two or more streams to merge into one with flow in the merged stream equal to the sum of the tributary flows. The program also permits diversions from streams. The groundwater flow model with the Streamflow-Routing Package has an advantage over the analytical solution in simulating the interaction between aquifer and stream because it can be used to simulate complex systems that cannot be readily solved analytically. The Streamflow-Routing Package does not include a time function for streamflow but rather streamflow entering the modeled area is assumed to be instantly available to

downstream reaches during each time period. This assumption is generally reasonable because of the relatively slow rate of groundwater flow. Another assumption is that leakage between streams and aquifers is instantaneous. This assumption may not be reasonable if the streams and aquifers are separated by a thick unsaturated zone. Documentation of the Streamflow-Routing Package includes data input instructions; flow charts, narratives, and listings of the computer program for each of four modules; and input data sets and printed results for two test problems, and one example problem. (Lantz-PTT)
PY: Publication Year
1989
DE: Descriptors
Surface-groundwater relations; Streamflow; Computer programs; Computer models; Model studies; Hydrologic models; Finite difference methods; Simulation analysis; Flow profiles; Model studies
CL: Classification
SW 0810 General; SW 0840 Groundwater
SF: Subfile
Water Resources Abstracts
AN: Accession Number
9005548

Record 76 of 153

TI: Title
Effect of the 1986 Drought on the Mississippi River Alluvial Aquifer
AU: Author
Spencer, JR; Ehret, KS
AF: Author Affiliation
Mississippi Bureau of Land and Water Resources Jackson
SO: Source
Proceedings of the Seventeenth Mississippi Resources Conference March 25-27, 1987, Mississippi. 1987. p 23-26, 6 fig, 1 tab, 3 ref.
AB: Abstract
Underlying the 7,000 sq mi alluvial plain in northwestern Mississippi commonly known as the ' the Delta ', is a shallow, highly productive groundwater-bearing unit, the Mississippi River alluvial aquifer. In 1980, about three-fourths of the total groundwater withdrawn in the State, chiefly for agriculture and aquaculture, was from this 80 ft to 180 ft of sand and gravel. The water-level declines experienced in the Delta over the past 10 years were greatly intensified by the record-setting drought during 1985-86. The drought conditions experienced in the winter and spring months combined with the tremendous demand placed on the aquifer for irrigation and aquaculture water resulted in the greatest yearly decline observed to date. The above average groundwater declines observed in the Mississippi River alluvial aquifer during April, 1986 in the Delta were due to the lack of precipitation and subsequent runoff. Groundwater levels near streams were affected most. This is because these areas lie in an aquifer recharge zone and possibly because of base-flow recharge. Further studies would be required to define precise areas of groundwater and surface water interaction. Since the major source of recharge for the Mississippi River alluvial aquifer is the Mississippi River, no long term effects due to the drought are anticipated. Water-level measurements made in the Delta during September, 1986, indicated no appreciable change in water level declines over previous years. However, this study has shown that during drought years, water levels are rapidly affected. The lack of recharge to the aquifer from the Mississippi River and runoff

from the Bluff Hills resulted in a dramatic lowering of the alluvial aquifer potentiometric surface. During these periods of temporary shortage, it may be necessary to further regulate groundwater use in affected areas. For this reason, a complete updated inventory of the alluvial aquifer is necessary for the formulation of sound water-managing policies within the Delta area to protect this vital and important natural resource. (See also W88-04665) (Lantz-PTT)

PY: Publication Year
1987

DE: Descriptors
Drought; Mississippi River aquifer; Aquifers; Groundwater level; Groundwater management; Groundwater recession; Rainfall-runoff relationships; Groundwater recharge; Water use; Potentiometric level

CL: Classification
SW 0840 Groundwater; SW 2040 Groundwater management

SF: Subfile
Water Resources Abstracts

AN: Accession Number
8804671

Record 77 of 153

TI: Title
An approach to modeling a stream aquifer system for conjunctive management

AU: Author
Zhang, Chuan-Mian; Morel-Seytoux, HJ; Young, RA

SO: Source
COLORADO WATER RESOURCES RESEARCH INSTITUTE, COLORADO STATE UNIVERSITY, FORT COLLINS, CO 80523 (USA), 1990, 145 pp

NT: Notes
Completion Report No. 170.

PB: Publisher
COLORADO WATER RESOURCES RESEARCH INSTITUTE, COLORADO STATE UNIVERSITY, FORT COLLINS, CO 80523 (USA)

AB: Abstract
A general methodology for modeling a groundwater system with complex boundary conditions by using the discrete kernel approach is developed. This methodology is applied in modeling a stream-aquifer system where the stream-aquifer relationship is in permanent hydraulic connection. Based on the fact that the interaction flux between stream and aquifer, i.e., return flow, is proportional to the difference between water levels in the river and in the aquifer, the stream-aquifer system is modeled as a boundary-value problem with a time-dependent third type boundary, which, in definition, is a kind of boundary condition where a linear combination of the piezometric head and its normal derivative is prescribed. This stream-aquifer model includes two parts. The first part is a discrete kernel generator, which generates drawdown discrete kernels and return flow discrete kernels by a finite difference model for the case of homogeneous initial conditions and homogeneous boundary conditions of the third type. These discrete kernels are calculated only once and saved. They are the characteristic coefficients which represent the linear relationship between excitations and responses for a particular physical system. The second part is a simulator, which simulate the responses of the system due to any kind of activities imposed on the system, such as pumping, recharge, irrigation, non-equilibrium of the initial conditions and variation of river stages, in terms of the discrete kernels.

LA: Language
English

SL: Summary Language
English
PY: Publication Year
1990
PT: Publication Type
Report
DE: Descriptors
model studies; aquifers; streams; water resources management; finite difference methods; simulation; groundwater; boundaries
CL: Classification
SW 5010 Network design
SF: Subfile
Water Resources Abstracts
AN: Accession Number
3719086

Record 80 of 153

TI: Title
Ecological Impact of Groundwater Extraction on Wetlands (Douro Basin, Spain)
AU: Author
Bernaldez, FG; Rey Benayas, JM; Martinez, A
AF: Author Affiliation
Departamento Interuniversitario de Ecologia, Madrid (Spain)
SO: Source
Journal of Hydrology JHYDA7, Vol. 141, No. 1/4, p 219-238, January 1993. 4 fig, 2 tab, 31 ref. Comision Asesora de Investigacion Ciencia y Tecnologia Grant No. PB85-0229-CO2.
AB: Abstract
Declining water-table levels in the Douro River basin, Central Spain, are caused by the extraction of groundwater from a relatively homogeneous aquifer, and may result in various types of impact on local wetlands, depending on their characteristics. These wetlands are local, intermediate, and regional groundwater-discharge sites, seepages from post- Tertiary deposits, and ponds not linked to groundwater systems. Important factors which influence the type of impact include: the recharge or discharge nature of the affected area; the type of connection with the regional aquifer; flow paths and residence times of the water; and the interaction between the water and the surface material, especially clay. Depending on the type of impact, a number of wetland values and functions may be affected. These include productivity, aesthetic, recreational, scientific, educational, and conservation values. (Author's abstract)
PY: Publication Year
1993
DE: Descriptors
Descriptors: *Douro River Basin; *Ecological effects; *Environmental impact; *Groundwater use; *Limnology; *Spain; *Surface-groundwater relations; *Wetlands; Aquatic habitats; Aquifer systems; Habitat conservation; Recreation; Water table decline
CL: Classification
SW 0840 Groundwater; SW 0850 Lakes
SF: Subfile
Water Resources Abstracts
AN: Accession Number
9306160

Record 81 of 153

TI: Title
Ground-Water Flow and Shallow-Aquifer Properties in the Rio Grande

Inner Valley South of Albuquerque, Bernalillo County, New Mexico
AU: Author
Peter, KD
AF: Author Affiliation
Geological Survey Albuquerque, NM. Water Resources Div
SO: Source
Available from Books and Open File Report Section, USGS Box 25425, Denver, Co 80225. USGS Water Resources Investigations Report 87-4015, 1987. 29p, 10 fig, 3 tab, 10 ref.
AB: Abstract
The purpose of this investigation was to describe the water table configuration and its temporal variations, estimate aquifer properties, and evaluate the interaction of groundwater and surface water in the inner valley of the Rio Grande in southern Albuquerque, New Mexico, where groundwater contamination is a continuing concern. The upper 150 ft of sedimentary deposits in the inner valley, mostly alluvium that consists of cobbles, gravel, sand, silt, and clay, was emphasized because of its susceptibility to contamination. A map of the water table on February 28, 1986 shows that flow generally is parallel to the river and the gradient is approximately 5 ft/mi or 0.0001. In areas affected by municipal and industrial groundwater withdrawals, declines may exceed 10 ft, and the water table gradient is as much as 20 ft/mi or 0.004. The gradient also is steeper near drains, particularly during the irrigation season. In the area east of the community of Mountainview the direction of water movement may have reversed between 1936 and 1986; flow near appears to be toward the east or southeast. Groups of four piezometers, each screened at a different depth, were monitored to describe seasonal changes of the water table. Vertical gradients between piezometers ranged from 0.014 upward to 0.047 downward from July 1985 to June 1986, but were downward most of the year, particulary during the irrigation season. The horizontal hydraulic conductivity of a 15-ft-thick clay and silt bed beneath Rio Bravo Boulevard is estimated to be 0.0001 ft/day. The average interstitial velocity down through this bed is estimated to range from about 0.0002 to 0.0005 ft/day. The fluctuations of the water table at the piezometers nearest the Rio Grande do not appear to be affected by the riverside drain. (Author 's abstract)
PY: Publication Year
1987
DE: Descriptors
Groundwater movement; Aquifers; Water table; New Mexico; Rio Grande River; Geohydrology; Groundwater pollution; Groundwater budget; Piezometers; Hydraulic conductivity; Flow velocity; Pore water
CL: Classification
SW 0840 Groundwater
SF: Subfile
Water Resources Abstracts
AN: Accession Number
8908619

Record 84 of 153

TI: Title
Quasi Three-Dimensional Modeling of Groundwater Flow in The Mesilla Bolson, New Mexico and Texas
AU: Author
Khaleel, R; Hawley, JW; Peterson, DM
AF: Author Affiliation
New Mexico Inst. of Mining and Technology Socorro. Geophysical Research Center
SO: Source

Available from National Technical Information Service, Springfield VA 22161, as PB86-236635. Price codes: A09 in paper copy. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report No. 178, October 1984. 185 p, 24 fig, 4 tab, 29 ref, 3 append, 10 plates. Project 1345645.

AB: Abstract
A quasi three-dimensional model of groundwater flow has been developed for the Mesilla Bolson and Mesilla Valley stream-aquifer system in southcentral New Mexico. The model can account for groundwater-surface water interaction through stream infiltration, canal losses, drain discharge, and evapotranspiration. Predictive runs with the quasi three-dimensional model suggest that with continued and increased pumping for 100 years in the vicinity of Las Cruces only, the piezometric head levels in the Santa Fe group within the cone of depression may be as much as 60 feet lower than existing levels. With the proposed El Paso wells on the West Mesa, piezometric head levels in the vicinity of the proposed well field may be as much as 200 to 400 feet lower than existing levels after 100 years of pumping, depending on recharge conditions in the Mesilla Valley and the behavior of storativity in the Santa Fe Group. The effects of proposed El Paso pumping on the West Mesa will be propagated to the Mesilla Valley; increased pumping will reduce drain flows and increase downward moving leakage. (Khaleel-N.M. Inst. Mining and Tech.)

PY: Publication Year
1984

DE: Descriptors
Numerical simulation; Subsurface hydrology; Mesilla Valley; Surface-groundwater relations; New Mexico; Texas; Groundwater movement; Stream-aquifer systems

CL: Classification
SW 0840 Groundwater; SW 2040 Groundwater management

SF: Subfile
Water Resources Abstracts

AN: Accession Number
8703564

Record 85 of 153

TI: Title
Effect of Shallow Penetration and Streambed Sediments on Aquifer Response to Stream Stage Fluctuations (Analytical Model)

AU: Author
Zlotnik, VA; Huang, Huihua

AF: Author Affiliation
Department of Geosciences, University of Nebraska-Lincoln, Lincoln, NE 68588-0340, USA; E-mail: vzlotnik@unl.edu

SO: Source
Ground Water [Ground Water], vol. 37, no. 4, pp. 599-605, Aug 1999

IS: ISSN
0017-467X

AB: Abstract
An analytical model of stream-aquifer interaction is proposed that considers the effects from a small degree of aquifer penetration and low-permeability sediments on the head response to an arbitrary stream-stage hydrograph. Aquifer sections under the stream and beyond are considered in a single model. The model of ground water flow in the aquifer is based on the Dupuit assumptions corrected for leakage from the stream. The model can use stream-stage hydrographs in both analytical and tabular forms. The nondimensional linear boundary value problem is solved for hydraulic head in the aquifer using numerical Laplace transforms and a convolution algorithm. The proposed solution is used to assess the impact of shallow penetration and low-permeability

streambed sediments on head responses by comparison with available solutions which neglect these factors.
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1999
PD: Publication Date
19990800
PT: Publication Type
Journal Article
DE: Descriptors
Surface-groundwater Relations; Streams; Aquifers; Hydrographs; Stages; Permeability; Groundwater
CL: Classification
SW 0810 General
UD: Update
199912
SF: Subfile
Water Resources Abstracts
AN: Accession Number
4584166

Record 87 of 153

TI: Title
Numerical ground-water flow modeling of the Snake River Plain aquifer using the superposition technique
AU: Author
Hubbell, JM; Bishop, CW; Johnson, GS; Lucas, JG
AF: Author Affiliation
Lockheed Idaho Technologies, 2151 N. Blvd., P. O. Box 1625, MS 2107, Idaho Falls, ID 83415, USA
SO: Source
Ground Water [GROUND WATER], vol. 35, no. 1, pp. 59-66, Feb 1997
IS: ISSN
0017-467X
NT: Notes
Contact: Ground Water Publishing Co., 6375 Riverside Dr., Dublin, OH 43017 (USA). PH: (800) 332-2104. FAX: (614) 761-3446.
AB: Abstract
Predictive ground-water flow modeling may be simplified by application of superposition when the governing equations are linear. The simplification allows evaluation of impacts of individual aquifer stresses and minimized model input, output, and interpretation. Modeling is performed by using (1) boundary conditions and aquifer properties provided by previous calibrations or analytical techniques, (2) setting the initial potentiometric surface and prescribed-head boundaries to an arbitrary horizontal datum, and (3) simulating a specific recharge or discharge stress. Superposition was applied to an existing, calibrated model of the Snake River Plain aquifer to simplify prediction of changes in interaction with the Snake River. Simulations predict the temporal relationships between ground-water use at multiple locations within the Snake River Plain and surface-water depletion in four hydraulically connected reaches of the Snake River. Simulated aquifer water use at a location approximately five miles from a hydraulically connected river reach results in river depletions greater than 80% of the pumping rate after 10 years. Water use further than 50 miles from hydraulically connected river reaches results in depletions from 10 to 30% of the annual average pumping rate after 100 years. Results present spatial and temporal impacts of water uses on the

Plain that are conceptually and quantitatively beneficial to water resources planners and water users.
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1997
PT: Publication Type
Journal Article
DE: Descriptors
USA, Snake R. Plain; groundwater movement; numerical analysis; hydrologic models; simulation; water use; surface-groundwater relations
ID: Identifiers
superposition
CL: Classification
SW 0840 Groundwater; SW 5010 Network design
SF: Subfile
Water Resources Abstracts
AN: Accession Number
4009547

Record 88 of 153

TI: Title
Implementation and use of direct-flow connections in a coupled ground-water and surface-water model
AU: Author
Swain, Eric D
AF: Author Affiliation
U.S. Geological Survey, Miami, FL, USA
SO: Source
Ground Water [GROUND WATER], vol. 32, no. 1, pp. 139-144, 1994
IS: ISSN
0017-467X
AB: Abstract
The U.S. Geological Survey's MODFLOW finite-difference ground-water flow model has been coupled with three surface-water packages - the MODBRANCH, River, and Stream packages - to simulate surface water and its interaction with ground water. Prior to the development of the coupling packages, the only interaction between these modeling packages was that leakage values could be passed between MODFLOW and the three surface-water packages. To facilitate wider and more flexible uses of the models, a computer program was developed and added to MODFLOW to allow direct flows or stages to be passed between any of the packages and MODFLOW. The flows or stages calculated in one package can be set as boundary discharges or stages to be used in another package. Several modeling packages can be used in the same simulation depending upon the level of sophistication needed in the various reaches being modeled. This computer program is especially useful when any of the River, Stream, or MODBRANCH packages are used to model a river flowing directly into or out of wetlands in direct connection with the aquifer and represented in the model as an aquifer block. A field case study is shown to illustrate an application.
LA: Language
English
PY: Publication Year
1994
PT: Publication Type
Journal Article
DE: Descriptors

Finite difference method; Mathematical models; Groundwater flow; Rivers; Stream flow; Flow interactions; Leakage (fluid); Computer software; Aquifers; Computer simulation
ID: Identifiers
Software package MODBRANCH; Software package MODFLOW; Direct flow connections
CL: Classification
EE 444.1 Surface Water; EE 444.2 Groundwater; EE 921.6 Numerical Methods; EE 631.2 Hydrodynamics; EE 723.1 Computer Programming; EE 723.5 Computer Applications
SF: Subfile
Environmental Engineering Abstracts
AN: Accession Number
0092260

Record 89 of 153

TI: Title
Modeling the effects of unsaturated, stratified sediments on groundwater recharge from intermittent streams
AU: Author
Reid, Mark E; Dreiss, Shirley J
AF: Author Affiliation
Univ of California, Santa Cruz, CA, USA
SO: Source
J HYDROL, vol. 114, no. 1-2, pp. 149-174, 1990
IS: ISSN
0022-1694
AB: Abstract
Unsaturated, stratified sediments beneath intermittent stream channels affect groundwater recharge from these streams. Using four different cases of sediment stratification. The authors simulate transient, variably saturated flow in a two-dimensional (2-D) vertical cross section between the stream and the underlying water table. These cases include: homogeneous sediments; low permeability layers. The permeability of the sediments in these cases greatly affects the timing and rate of channel loss and groundwater recharge. Flow patterns and the style of stream/water table connection are controlled by the location and geometry of low permeability sediments. In cases with homogeneous sediments and narrow, low permeability lenses, stream/water table connection occurs by a saturated column advancing from above. In cases with low permeability streambed sediments and extensive, low permeability layers, connection occurs by a water table mound building from below. The style of stream/water table connection suggests simplified physically based interaction models that may be appropriate for these settings.
LA: Language
English
PY: Publication Year
1990
PT: Publication Type
Journal Article
DE: Descriptors
Flow of Water--Mathematical Models; Water Resources--Groundwater
ID: Identifiers
Groundwater Recharge Modeling; Intermittent Stream Flow; Stream/Aquifer Interactions; Stratified Sediments
CL: Classification
EE 444 Water Resources; EE 631 Fluid Flow; EE 921 Applied Mathematics
SF: Subfile
Environmental Engineering Abstracts
AN: Accession Number

0106058

Record 91 of 153

TI: Title
Influence of the Suwannee River on ground water height and geochemistry of the Upper Floridan aquifer
AU: Author
Hirten, JJ
AF: Author Affiliation
Univ. Florida, Gainesville, FL 23611, USA
CF: Conference
Conserv '96: Responsible Water Stewardship, Orlando, FL (USA), 4-8 Jan 1996
SO: Source
PROCEEDINGS OF CONSERV '96., AMERICAN WATER WORKS ASSOCIATION, DENVER, CO 80235 (USA), 1995, pp. 971-975
IB: ISBN
0-89867-837-4
PB: Publisher
AMERICAN WATER WORKS ASSOCIATION, DENVER, CO 80235 (USA)
AB: Abstract
The Lower Suwannee River Basin is located in north-central Florida. The basin demonstrates surface water and ground water interaction between the Suwannee River and the Floridan aquifer. This project hopes that by understanding this relationship the high quality of the ground water in the region can be preserved. The surface water/ground water interaction may be an important factor in storing, detaining and naturally mediating pollutants in the Suwannee Basin. The ground water quality data was collected in 1981-1994 by the United States Geological Survey (USGS), Florida Department of Environmental Protection (DEP) and Florida Geological Survey (FGS). The ground water monitoring wells are located along the river from Branford, FL to Ellaville, FL and within a five-mile distance from the river. The river had a distinct effect on the potentiometric surface in many areas. The geochemical changes within the aquifer were less pronounced.
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1995
PT: Publication Type
Book Monograph; Conference
DE: Descriptors
USA, Florida, Suwannee R. Basin; Surface-groundwater relations; water quality control; potentiometric level; geochemistry; river basins; monitoring; test wells; hydrologic data collections; aquifer characteristics
CL: Classification
SW 0810 General
SF: Subfile
Water Resources Abstracts
AN: Accession Number
3901861

Record 92 of 153

TI: Title
Conjunctive Use of Surface and Ground Waters
AU: Author
Morel-Seytoux, HJ
AF: Author Affiliation

Colorado State Univ. Fort Collins. Dept. of Civil Engineering
SO: Source
Artificial Recharge of Groundwater, Butterworth Publishers, Boston Massachusetts. 1985. p 35-67, 8 fig, 2 tab, 33 ref. NSF Grant ENG78-00733; Ministry of Agriculture and Water (Saudi Arabia) Cooperation agreeement 58-319R-8-134; Office of Water Research and Technology Contract B-207-Colorado, Agreement 14-34-0001-0260.
AB: Abstract
It is fairly evident that in view of their very distinct and complementary nature, there is a definite advantage in conjunctive development and operations of surface and groundwaters. In regions with limited water supply, this practice is imperative. Whereas groundwater was at the start viewed as a small complementary alternative to pure reliance on stream flows (for example, in the Wadi Jizan in Saudi Arabia or in the South Platte in Colorado), gradually the point of view is changing to one in which groundwater is considered as a prime water supply. In this perspective the river flows now have a role, at least partially, of providers of recharge to the aquifer. That role cannot be played efficiently and it cannot be managed optimally without a good understanding of the hydrology of recharge. For this reason, much of this chapter has been dedicated to a study of infiltration, redistribution, recharge, and generated stream (or basin)-aquifer interaction. Management of the resource takes place of necessity within a society, characterized by its own institutions, laws, dynamics, and inertia. Tools that can help a planner to manage such a complex system exist. Their use has been illustrated in situations that are at least highly realistic, if not real. The outcome of a work of synthesis is only as good as the parts that constitute the whole. Good planning is not possible without the proper technologic input. (See also W87-08137) (Lantz-PTT)
PY: Publication Year
1985
DE: Descriptors
Conjunctive; Surface-groundwater relations; Groundwater management; Groundwater recharge; Water supply development; Water supply; Aquifers; Aquifer management; Artificial recharge
CL: Classification
SW 0840 Groundwater; SW 2040 Groundwater management
SF: Subfile
Water Resources Abstracts
AN: Accession Number
8708140

Record 94 of 153

TI: Title
Analysis of a 72-hour pumping test of an unconfined buried valley aquifer: Newark well feld, Licking County, Ohio
AU: Author
Spahr, PN; Hallfrisch, MP; Petty, RJ; Angle, MP; Jones, W; Storts, KM; Davis, D
AF: Author Affiliation
ODNR, Div. Water, 1939 Fountain Sq. Dr., Columbus, OH 43224, USA
CF: Conference
102. Annual Meeting of The Ohio Academy of Science, Youngstown, OH (USA), 30 Apr-2 May 1993
SO: Source
Ohio Journal of Science [OHIO J. SCI.], vol. 93, no. 2, p. 38, 1993
IS: ISSN
0030-0950
AB: Abstract

A 72-hour pumping test was conducted by the ODNR, Div. of Water, Ground Water Resource Section, at the Newark Well Field to assess the hydraulic properties of an unconfined buried valley aquifer. The constant discharge rate of 1800 G.P.M. was determined by a preliminary step test. Nested piezometers were installed at various spacings from the pumping well. Shallow well points and stream bed permeameters were used in the North Fork of the Licking River to determine the interaction between the river and aquifer. Graphical analyses were performed upon the draw down data to evaluate the vertical and horizontal conductivities of the aquifer system. The analysis, projections and recommendations were used as part of a Non-Point Source study of the Licking River buried valley aquifer system.

LA: Language
English
PY: Publication Year
1993
PT: Publication Type
Journal Article; Conference; Summary
DE: Descriptors
pumping tests; unconfined aquifer; aquifer characteristics; hydraulic properties; piezometers; permeameters; USA, Ohio; groundwater management; surface-groundwater relations
CL: Classification
SW 2040 Groundwater management
SF: Subfile
Water Resources Abstracts
AN: Accession Number
3679012

Record 95 of 153

TI: Title
Environmental Isotope-Aided Study on River Water and Groundwater Interaction in the Region of Seoul and Taegu
AU: Author
Airey, P; Payne, B; Hahn, JS; Suh, IS; Ahn, JS
AF: Author Affiliation
Korea Advanced Energy Research Inst
SO: Source
Appropriate Methodologies for Development and Management of Groundwater Resources in Developing Countries. Volume I. Papers Presented at an International Workshop held February 28-March 4, 1989. A. A. Balkema, Rotterdam, The Netherlands. 1989. p 371-384 , 21 fig, 3 tab, 15 ref.
AB: Abstract
Environmental isotope aided studies on river water and groundwater interaction in the Han River Basin, Korea, in areas composed of crystalline rocks and limestone, were conducted. The results indicate that the groundwater in the Seoul area is recharged by the Han River. In non-urban areas, the groundwater is recharged by infiltration and precipitation. The crystalline rock aquifers are recharged by downward percolation of shallow groundwater stored in overlying alluvium. Older groundwater has a low concentration of tritium ranging from 0-2 TU, and is observed at the lower Han River Basin near Bupyeong. This may indicate that the water sampled was recharged at a much earlier time than other groundwater that was sampled; possibly as early as the pre-thermonuclear period. The interaction study conducted in the karst area showed that there was no systematic difference in tritium levels between surface water and groundwater, and that the residence time of groundwater in limestone is probably not longer than a few months. The area recharged by water from the overlying alluvium into the sedimentary rock aquifer was restricted only

along the Kumho River channel and its tributaries in a classic sedimentary rock area. Bedrock groundwater whose tritium level and stable isotope composition was less than 14 TU and -6.8 respectively and was observed in the central part of Taegu. (See also W91-00215) (Lantz-PTT)
PY: Publication Year
1989
DE: Descriptors
Geohydrology Groundwater recharge Korea Seoul; Surface-groundwater relations Taegu Tritium Crystalline rocks; Han River Basin Infiltration Limestone Paleohydrology; Percolation Tracers
CL: Classification
SW 0810 General; SW 0840 Groundwater
SF: Subfile
Water Resources Abstracts
AN: Accession Number
9100257

Record 101 of 153

TI: Title
Interaction of ground water with the Rock River near Byron, Illinois
AU: Author
Avery, CF
SO: Source
U.S. GEOL. SURVEY, EARTH SCIENCE INFORMATION CENTER, OPEN-FILE REPORTS SECTION, BOX 25286, MS 517, DENVER, CO 80225 (USA), 1994, 26 pp
NT: Notes
USGS Water-Resources Investigations Report: 94-4034.
PB: Publisher
U.S. GEOL. SURVEY, EARTH SCIENCE INFORMATION CENTER, OPEN-FILE REPORTS SECTION, BOX 25286, MS 517, DENVER, CO 80225 (USA)
AB: Abstract
Ground-water discharge to the Rock River in the study area, estimated by three independent methods, ranged from 16,300 to 30,900 cubic feet per day; the low value, determined by the use of the modified Darcy equation, is an estimate only of ground-water discharge from the southern side of the Rock River. The vertical distribution of trichloroethene (TCE) in ground water was determined at a test hole along the estimated centerline of the contaminant plume and as close to the river as property access would allow. The maximum concentrations of TCE of 3 micrograms per liter were found at depths of 59 and 64 feet. The contaminant was dispersed across a vertical interval of about 75 feet at depths of 19 and 94 feet. All of the TCE in ground water discharges to the Rock River because no TCE was detected below a depth of 109 feet, and increasing vertical head gradients with depth indicate ground-water flow from a depth of 119 feet is to the river. The maximum possible discharge of TCE is estimated to be about 1.7 grams per day. A finite-difference numerical model was used to simulate ground-water flow along a vertical section through the ground-water system from the Byron Superfund site to the Rock River. Results of the ground-water flow simulation indicate that, if underflow in the St. Peter aquifer occurs beneath the Rock River, it would be water that was present at depth in the flow system at the Byron Superfund site rather than contaminated water that had recharged the system in the vicinity of the Byron Superfund site.
LA: Language
English
SL: Summary Language
English

PY: Publication Year
1994
PT: Publication Type
Report
DE: Descriptors
USA, Illinois, Rock R.; surface-groundwater relations; groundwater pollution; groundwater movement; plumes; finite difference methods; numerical analysis; model studies
ID: Identifiers
trichloroethene
CL: Classification
SW 0810 General
SF: Subfile
Water Resources Abstracts
AN: Accession Number
3781342

Record 102 of 153

TI: Title
Chemical Interactions Between Surface Water and Ground Water in the Zekiah Swamp Run Stream Valley
AU: Author
Price, RM; Keating, RW
SO: Source
IN: Ground Water Issues and Solutions in the Potomac River Basin/Chesapeake Bay Region. National Water Well Association, Dublin, Ohio. 1989. p 31-45. 5 fig, 2 tab. 7 ref.
AB: Abstract
Zekiah Swamp Run, in Charles County, Maryland, drains an area of approximately 110 square miles into the Wicomico River, a tributary of the Potomac River. An electric utility fly ash fill is located towards the southern end of the north-south trending Zekiah Swamp Run Valley. Dissolved major ion constituents, derived from the fly ash fill, were used as tracers to investigate the chemical interactions between surface water and groundwater within the valley. Groundwater occurs under unconfined conditions in the Pleistocene Age sand and gravel aquifer. This aquifer is five to twenty feet thick and underlain by the confining silts of the Calvert Formation. Intermittent streams in the watershed are tributaries of Zekiah Swamp Run, and in places are hydraulically connected to the sand and gravel aquifer. Nine observation wells in the sand and gravel aquifer provided hydrologic and groundwater quality data. Groundwater samples and twelve surface water samples were collected and analyzed for major cations and anions during three consecutive bimonthly sampling events. Stiff diagrams were constructed using major ion constituents to determine the chemical interaction between groundwater and surface water. These diagrams indicate that groundwater discharges to the upper reaches of the intermittent streams, thereby affecting the chemical character of the streams there. Further downgradient the reverse seems to be true; the intermittent streams recharge the aquifer system prior to discharge, affecting the water chemistry of the groundwater. (See also W91-09628) (Author's abstract)
PY: Publication Year
1989
DE: Descriptors
Base flow; Dissolved solids; Groundwater; Influent streams; Surface-groundwater relations; Water chemistry; Chemical analysis; Fly ash; Maryland; Stiff diagrams; Stream discharge; Tracers
CL: Classification
SW 0840 Groundwater; SW 0835 Streamflow and runoff; SW 0880 Chemical processes
SF: Subfile

Water Resources Abstracts
AN: Accession Number
9109631

Record 103 of 153

TI: Title
Surface Water and Groundwater Interactions in a Surficial Aquifer in Northwest Iowa
AU: Author
Arfa, H
AF: Author Affiliation
Iowa State Univ. Ames. Dept. of Civil Engineering
SO: Source
PhD Thesis 1980. 250 p, 36 Fig, 36 Tab, 123 Ref, 4 Append. University Microfilms International, Ann Arbor, MI; Order No GAX80-19621.
AB: Abstract
The objective of this research is to evaluate a surficial aquifer and its interaction with surface runoff, with an objective of constructing a general mathematical model to respond to these interrelations. To evaluate the application of probabilistic laws to surficial groundwater fluctuations, a study of the sequential variation of rainfall in Northwest Iowa was conducted. Rainfall variations were defined, from dry-dry to wet-wet sequences. The interaction between surface water and surficial groundwater is a complicated phenomenon, and a strong tool is needed. The best tool for this situation, to be both practical and reliable, is the use of mathematical models. The basin selected for study is the Floyd River Basin, above Alton, which has the approximate geometry and dimensions of a unit model of interest. Full emphasis is put on recharge concepts of surficial groundwater in the basin, and the capability of the aquifer to withstand temporary mining or over-drafting to meet the beneficial water use requirements of the basin. The text of this dissertation includes the essential scientific theories and definitions, results obtained, and considers the practical laws of interactions with necessary discussion. (Sinha-OEIS)
PY: Publication Year
1980
DE: Descriptors
Mathematical models; Groundwater recharge; Surface-groundwater relations; Iowa; Water level fluctuations; Surface water; Surface runoff; Groundwater; Rainfall; Aquifers; Water requirements; Groundwater fluctuations
CL: Classification
SW 0810 General; SW 0840 Groundwater
SF: Subfile
Water Resources Abstracts
AN: Accession Number
8203718

Record 104 of 153

TI: Title
Modelling hydrogeochemical aspects of deep-infiltration into a drinking well aquifer
AU: Author
Riezebos, RO; Van Gaans, PFM; De Ruiter, JC
AF: Author Affiliation
Bilderdijkstraat 48 super(bis), 3532 VH Utrecht, The Netherlands
CF: Conference
International Symposium on Artificial Recharge of Groundwater, Helsinki (Finland), 3-5 Jun 1996

ED: Editor
Kivimaki, AL; Suokko, T (eds)
SO: Source
ARTIFICIAL RECHARGE OF GROUNDWATER. PROCEEDINGS OF AN INTERNATIONAL SYMPOSIUM, HELSINKI, FINLAND, JUNE 3-5, 1996., FINNISH ENVIRONMENT INSTITUTE, PO BOX 140, RIN-00251, HELSINKI (FINLAND), 1996, pp. 289-294,
IS: ISSN
0900-0267
IB: ISBN
951-715-264-7
PB: Publisher
FINNISH ENVIRONMENT INSTITUTE, PO BOX 140, RIN-00251, HELSINKI (FINLAND)
AB: Abstract
Storage of winter surplus surface water using river bank extraction, through deep-infiltration into a drinking water aquifer was proposed. The various stages and processes, from river water via purification to the interaction of different water types within the aquifer after deep-infiltration, were schematized. Representative water samples were selected at the various stages of this scheme. The water samples were chemically combined with each other and modelled using the existing chemical computer models WATEQX and PHREEQE. In terms of inorganic chemistry no major problems with deep-infiltration were found. It was concluded that the proposed system of bank extraction in combination with deep-infiltration, could achieve the goals set.
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1996
PT: Publication Type
Book Monograph; Conference
DE: Descriptors
Netherlands; geochemistry; infiltration; computer models; drinking water; aquifer management; model studies; groundwater storage; water sampling; groundwater recharge
ID: Identifiers
WATEQX; PHREEQE
CL: Classification
SW 2040 Groundwater management
SF: Subfile
Water Resources Abstracts
AN: Accession Number
3999628

Record 105 of 153

TI: Title
Columbia Plateau Basalt Regional Aquifer-System Study
AU: Author
Vaccaro, J
AF: Author Affiliation
Geological Survey Tacoma, WA. Water Resources Div
SO: Source
Regional Aquifer-System Analysis Program of the U.S. Geological Survey: Summary of Projects 1978-84, U.S. Geological Survey Circular 1002, 1986. p 141-145, 3 fig, 3 ref.
AB: Abstract
The basaltic rocks that compromise the regional aquifer underlying the Columbia Plateau are located in central and eastern Washington, northern Oregon, and a small part of northwestern

Idaho. The Plateau covers about 70,000 sq mi entirely within the drainage of the Columbia River and is bordered on the west by the Cascade Range, on the north and east by the Rocky Mountains, and on the south by the Blue Mountains. Major tributaries to the Columbia River on the Plateau are the Snake, Spokane, John Day, Yakima, Palouse, and Deschutes Rivers. The topography of the Plateau is varied and includes: (1) major mountains consisting of a geologically young folded region of large anticlines and synclines, and (2) low relief features. The Columbia Plateau Basalt regional aquifer system study was started in 1982 and is scheduled for completion in 1986. The study was designed to address some of the hydrologic problems currently being encountered on the plateau. These problems include: (1) declining water levels of as much as 20 ft/yr; (2) the occurrence of sodium-enriched water; (3) the need for additional groundwater for expanding irrigated land; (4) the lack of knowledge of the effects of increased development of the aquifer system; (5) the lack of knowledge of interaction between groundwater and surface water; and (6) the potentiality of using the low-permeability zones of the deep basalts as a national repository site for solidified high-level nuclear wastes near Richland, WA. (See also W87-07312) (Lantz-PTT)

PY: Publication Year
1986

DE: Descriptors
Aquifer systems; Columbia Plateau; Washington; Oregon; Groundwater resources; Geohydrology; Idaho; Groundwater levels; Sodium; Irrigation; Aquifers; Permeability coefficient; Groundwater recharge; Basalts

CL: Classification
SW 0840 Groundwater

SF: Subfile
Water Resources Abstracts

AN: Accession Number
8707322

Record 107 of 153

TI: Title
Streamflow Gains and Losses in the Snake River and Ground-Water Budgets for the Snake River Plain, Idaho and Eastern Oregon

AU: Author
Kjelstrom, LC

SO: Source
Available from the US Geological Survey, Books and Open-File Reports Section, Box 25425, Denver, CO 80225. USGS Open-File Report 90-172, 1992. 75p, 49 fig, 14 tab, 40 ref, 1 plate.

AB: Abstract
The Snake River is the regional drain for streams and aquifers in the Snake River basin upstream from Weiser, Idaho. The interaction between the river and groundwater was quantified as streamflow gains from and losses to the aquifers. The largest continuous streamflow gain upstream from Milner is from springs between Blackfoot and Neeley, where, in 1980, the Snake River gained 1.9 million acre-ft of groundwater. Downstream from Milner, the Snake River is a gaining stream. Gains are largest between Milner and King Hill where numerous springs discharge to the river. In 1980, the Snake River gained 4.7 million acre-ft of groundwater between Milner and King Hill. Although large springs were present in the Blackfoot-to-Neeley and Milner-to-King Hill reaches before irrigation began on the plain, the application of surface water for irrigation increased recharge to the Snake River Plain aquifer; therefore, spring discharge to both reaches also increased. The changes in groundwater recharge and discharge and

groundwater storage generally are the net result of 100 successive years of irrigation on the Snake River Plain. Water budget analyses indicate that the total volume of groundwater in storage in the main part of the eastern Snake River Plain increased about 24 million acre-ft from 1880 to 1952, largely as a result of increased recharge in areas irrigated with surface water. The total volume of groundwater in storage decreased about 6 million acre-ft from 1952 to 1980 as a result of several years of below normal precipitation, increased pumping of groundwater for irrigation, and other changes in irrigation practices. Groundwater storage in parts of the western plain increased about 3 million acre-ft from 1930 to 1972, but has generally decreased since 1972. (Lantz-PTT)

PY: Publication Year
1992

DE: Descriptors
*Groundwater resources; *Idaho; *Oregon; *Snake River; *Streamflow; *Surface-groundwater relations; Aquifers; Flow discharge; Groundwater recharge; Irrigation effects; Snake River Basin; Springs

CL: Classification
SW 0835 Streamflow and runoff; SW 0840 Groundwater

SF: Subfile
Water Resources Abstracts

AN: Accession Number
9302791

Record 108 of 153

TI: Title
Hydrology of a headwater basin wetland. Groundwater discharge and wetland maintenance

AU: Author
Roulet, Nigel T

AF: Author Affiliation
York Univ, North York, Ont, Can

SO: Source
HYDROL PROCESSES, vol. 4, no. 4, pp. 387-400, 1990

IS: ISSN
0885-6087

AB: Abstract
The link between groundwater and surface hydrology in a small headwater drainage basin in the zone of glacial deposition of southern Ontario south of the Precambrian Shield was examined for two years. The basin is situated in a discharge zone of a regional aquifer and contains a small treed spring-fed swamp. The swamp exists because of the groundwater and has little effect on the maintenance of streamflow. G Groundwater input to the swamp is an order of magnitude larger than precipitation. Groundwater of local and regional origin passes through the swamp by two routes: surface streamlets, where groundwater that emerges at specific seepage points in the swamp is conveyed over the ground surface with little interaction with the swamp itself, and by diffuse seepage in the swamp and through the bed of the stream. While the diffuse seepage input is the smaller component of groundwater it maintains the swamp's saturation. Groundwater input to the swamp from the specific seepage points and diffuse flow varies little over a year; therefore the saturation of the swamp and baseflow from the basin display little seasonal variation compared to other wetland types. The existence of the valley bottom in the headwater basin alters the seasonal and storm hydrology and is important to biogeochemical transformation of emerging groundwater.

LA: Language
English

PY: Publication Year
1990
PT: Publication Type
Journal Article
DE: Descriptors
Hydrology--Computer Simulation; Water Resources--Groundwater; Stream Flow--Monitoring
ID: Identifiers
Wetlands; Baseflow; Seepage Points; Swamps; Groundwater Flow
CL: Classification
EE 442 Flood Control; L and Reclamation; EE 444 Water Resources; EE 471 Marine Science and Oceanography; EE 631 Fluid Flow; EE 723 Computer Software, Data Handling and Applications
SF: Subfile
Environmental Engineering Abstracts
AN: Accession Number
0109749

Record 110 of 153

TI: Title
Using super(222)Rn to examine groundwater/surface discharge interaction in the Rio Grande de Manati, Puerto Rico
AU: Author
Kelly Ellins, K; Roman-Mas, A; Lee, R
AF: Author Affiliation
Univ of Florida, Gainesville, FL, USA
SO: Source
J HYDROL, vol. 115, no. 1-4, pp. 319-341, 1990
IS: ISSN
0022-1694
AB: Abstract
super(222)Rn was used in the karst drainage basin of the Rio Grande de Manati in Puerto Rico to study groundwater/surface flow relationships. Locations of groundwater influx along two sections of the Rio Grande de Manati were identified. The super(222)Rn measurements were used together with stream discharge data in a mass balance equation to quantify the groundwater inputs. The investigation established that both of the sections of the Rio Manati surveyed not only gained groundwater, but lost surface flow. It was calculated that the river gained about 1.2m super(3)s super(-1) and lost 0.5m super(3)s super(-1) to the aquifer between Ciales and United States Geological Survey gauging station 5. Between United States Geological Survey gauging stations 6 and 7, groundwater influx and stream flow loss occurred-simultaneously with groundwater inputs equalling surface discharge losses of 4m super(3)S super(-1). The study successfully demonstrated the innovative application of super(222)Rn as a geochemical tracer in examining groundwater/surface flow relationships in a karst system.
LA: Language
English
PY: Publication Year
1990
PT: Publication Type
Journal Article
DE: Descriptors
Hydrology - Environmental Testing; Radon - Isotopes; Flow of Water - Underground; Runoff
ID: Identifiers
Surface Discharge; Rio Grande De Manati; Radon-222; Environmental Tracers
CL: Classification
EE 407 Maritime and Port Structures; R ivers and Other Waterways;

EE 444 Water Resources; EE 804 Chemical Products Generally; EE 631 Fluid Flow; EE 471 Marine Science and Oceanography
SF: Subfile
Environmental Engineering Abstracts
AN: Accession Number
0106621

Record 113 of 153

TI: Title
A computer model for simulating water quality and quantity in a wellfield in an alluvial aquifer.
AU: Author
Gilliland, MW; Nguyen, QM
AF: Author Affiliation
Dep. Civ. Eng., Univ. Nebraska, Omaha, NE 68182, USA
SO: Source
Ground Water [GROUND WATER.], vol. 25, no. 2, pp. 151-159, 1987
IS: ISSN
0017-467X
AB: Abstract
A surface-water/ground-water interaction computer model was developed for the Grand Island, Nebraska municipal wellfield. This finite-difference model, which is two-dimensional in plan view, includes both quantity and quality components. The quantity component is a modified version of the Prickett-Lonnquist model. Modifications account for the effects of the Platte River channels, which flow through the modeled area, and adjust water levels at pumping wells to account for the difference between the well radius and the grid size. The quality component of the model calculates nitrate concentrations in pumping wells penetrating aquifers which are vertically stratified with respect to nitrate. The model also estimates amounts of recharge from the river to the aquifer and the direction and velocity of movement of ground water in several nitrate contaminated areas adjacent to the wellfield.
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1987
PT: Publication Type
Journal Article
DE: Descriptors
computer applications; water quality; aquifers; Nebraska, Grand Island; rivers; mathematical models
CL: Classification
P 2000 FRESHWATER POLLUTION; C CA1.8.6 ECOLOGY; C CA15.2 GEOLOGY
SF: Subfile
Pollution Abstracts; Computer and Information Systems Abstracts
AN: Accession Number
1546269

Record 114 of 153

TI: Title
Chemical evolution of groundwater in a first-order catchment and the process of salt accumulation in the soil profile.
AU: Author
Salama, RB; Farrington, P; Bartle, GA; Watson, GD
AF: Author Affiliation
CSIRO, Wembley, Aust
SO: Source
Journal of Hydrology [J HYDROL.], vol. 143, no. 3-4, pp. 233-258,

1993
IS: ISSN
0022-1694
AB: Abstract
The chemical characteristics of surface water, base flow and groundwater in a first-order catchment in the wheatbelt of Western Australia were used to study the weathering process and its relationship to the development of groundwater and stream salinity. Meteoric water infiltrates through the unsaturated zone to the water table aquifer and through the aquifer outcrop in the case of a confined aquifer. The groundwater composition changes in space and time, becoming more saline with depth and distance away from the recharge zone. The concentration of salt in the system can be explained by four main mechanisms: withdrawal of water through uptake by plant roots for transpiration; loss of water during the weathering process and the formation of new minerals; leakage between aquifers; evaporation upstream of geological structures and near discharge zones. The groundwater is mainly of Na-Cl type, and is at saturation with respect to most of the carbonate minerals, chalcedony, talc and tremolite. The water changes in its chemical composition as rock-water interaction takes place. The weathering products are gibbsite and kaolinite, with the release of Na super(+), K super(+), Mg super(2+), Ca super(2+), HCO sub(3) super(-), and H sub(4)SiO sub(4). The preclearing weathering products are produced in a system open to Co sub(2) (through the plant roots), with groundwater under this system having excess Na super(+). After clearing the system becomes depleted in CO sub(2) and the groundwater becomes depleted in Na super(+) through exchange with Mg super(2+) from the rock surface. Geochemical modelling showed that most of the constituents in groundwater can be accounted for by taking into consideration the constituents of rainfall, with minor additions from the weathering process.
LA: Language
English
PY: Publication Year
1993
PT: Publication Type
Journal Article
DE: Descriptors
Hydrology; Salts; Soils; Water analysis; Chemical analysis
ID: Identifiers
Catchments; Salt accumulation; Surface water; Stream salinity
CL: Classification
CS 444.2 Groundwater; CS 444.1 Surface Water; CS 483.1 Soils and Soil Mechanics; CS 801.1 Chemistry (General); EE 444.2 Groundwater; EE 444.1 Surface Water; EE 483.1 Soils and Soil Mechanics; EE 801.1 Chemistry (General)
SF: Subfile
Civil & Structural Engineering Abstracts; Environmental Engineering Abstracts
AN: Accession Number
0044324

Record 115 of 153

TI: Title
Groundwater/surface water interaction in a Florida augmentation lake
AU: Author
Belanger, TV; Kirkner, RA
AF: Author Affiliation
Dep. Oceanogr., Ocean Eng. and Environ. Sci., Florida Inst. Technol., Melbourne, FL 32901, USA

SO: Source
LAKE RESERVOIR MANAGE., vol. 8, no. 2, pp. 165-174, 1994
IS: ISSN
0743-8141
AB: Abstract
Mountain Lake, Florida, is augmented with water pumped from the underlying Floridan aquifer to maintain the water level, and a detailed 1990 water budget was developed for this lake to determine how the lake interacts with the surrounding groundwater system. Groundwater interaction with the lake was calculated from flow-net analysis of surficial well data, seepage meter data, and the residual of the water budget equation. Strong leakage through the lake bottom was observed, primarily controlled by the head difference between the lake and the Floridan aquifer and the sediment hydraulic leakance (sediment hydraulic conductivity/thickness). Areas of seepage into the lake (15% of the lake area) were observed at possible sinkhole features in the central portion of the lake. Areas of strong leakage occurred in shore areas where steep outflow gradients and sandy sediments existed. Results from this study indicate that the lake recycles groundwater, as the equivalent of over 90% of augmentation water returns to the groundwater system. Water budget data from this lake dispute the public perception in Florida that lake augmentation is a wasteful practice.
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1994
PT: Publication Type
Journal Article
DE: Descriptors
surface-groundwater relations; aquifers; hydrologic budget; lakes; surface water; seepage; leakage; USA, Florida, Mountain L.; ground water; pumping; water budget; interactions; augmentation; water levels; seepages; water management
ER: Environmental Regime
Freshwater
TR: ASFA Input Center Number
CS9414796
CL: Classification
SW 0810 General; SW 0840 Groundwater; SW 0850 Lakes; Q2 02171 Dynamics of lakes and rivers; Q5 01523 Conservation, wildlife management and recreation
SF: Subfile
Water Resources Abstracts; ASFA 2: Ocean Technology Policy & Non-Living Resources; ASFA 3: Aquatic Pollution & Environmental Quality
AN: Accession Number
3603254

Record 117 of 153

TI: Title
Interactions between ground water and surface water in the Suwannee River basin, Florida
AU: Author
Katz, BG; DeHan, RS; Hirten, JJ; Catches, JS
AF: Author Affiliation
U.S. Geol. Surv., 227 N. Bronough St., Suite 3015, Tallahassee, FL 32301, USA
SO: Source
Journal of the American Water Resources Association [J. Am. Water

Resour. Assoc.], vol. 33, no. 6, pp. 1237-1254, Dec 1997
IS: ISSN
1093-474X
AB: Abstract
Ground water and surface water constitute a single dynamic system in most parts of the Suwannee River basin due to the presence of karst features that facilitate the interaction between the surface and subsurface. Low radon-222 concentrations (below background levels) and enriched amounts of oxygen-18 and deuterium in ground water indicate mixing with surface water in parts of the basin. Comparison of surface water and regional ground water flow patterns indicate that boundaries for ground water basins typically do not coincide with surface water drainage subbasins. There are several areas in the basin where ground water flow that originates outside of the Suwannee River basin crosses surface water basin boundaries during both low-flow and high-flow conditions. In a study area adjacent to the Suwannee River that consists predominantly of agricultural land use, 18 wells tapping the Upper Floridan aquifer and 7 springs were sampled three times during 1990 through 1994 for major dissolved inorganic constituents, trace elements, and nutrients. During a period of above normal rainfall that resulted in high river stage and high ground water levels in 1991, the combination of increased amounts of dissolved organic carbon and decreased levels of dissolved oxygen in ground water created conditions favorable for the natural reduction of nitrate by denitrification reactions in the aquifer. As a result, less nitrate was discharged by ground water to the Suwannee River.
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1997
PD: Publication Date
19971200
PT: Publication Type
Journal Article
DE: Descriptors
USA, Florida, Suwannee R.; River Basins; Surface-groundwater Relations; Nitrates; Geochemistry; Water Quality; Geohydrology; Tracers; Isotope Studies; Watershed Management; Karst; Denitrification; Surface water; Ground water; Rivers; Watersheds; Hydrology; USA, Florida, Suwannee R.
ID: Identifiers
karsts; USA, Florida, Suwannee R.
ER: Environmental Regime
Freshwater
TR: ASFA Input Center Number
CS9804928
CL: Classification
SW 0810 General; Q2 02184 Composition of water
UD: Update
199803
SF: Subfile
Water Resources Abstracts; ASFA 2: Ocean Technology Policy & Non-Living Resources
AN: Accession Number
4256257

Record 124 of 153

TI: Title
Two-dimensional modelling of water table fluctuation in response

to localised transient recharge
AU: Author
Rai, SN; Singh, RN
AF: Author Affiliation
Natl. Geophys. Res. Inst., Hyderabad - 500 007, India
SO: Source
Journal of Hydrology (Amsterdam) [J. HYDROL. (AMST.)], vol. 167, no. 1-4, pp. 167-174, 1995
IS: ISSN
0022-1694
AB: Abstract
An analytical solution of the linearised Boussinesq equation is presented and used to predict the spatio-temporal variation of the water table in a finite aquifer system in response to a transient recharge from an overlying rectangular basin. The boundary conditions of the finite aquifer are taken as fixed heads, which would apply when the aquifer system is surrounded by open water bodies. Application of the solution is illustrated with the help of a numerical example. The results would also have applications in studying stream-aquifer interaction in the presence of transient recharge.
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1995
PT: Publication Type
Journal Article
DE: Descriptors
groundwater recharge; water table; estimating equations; water level fluctuations; aquifer characteristics; surface-groundwater relations; streams; unconfined aquifers; ground water; water resources; water levels; Boussinesq approximation; boundary conditions; mathematical models
ER: Environmental Regime
Freshwater
TR: ASFA Input Center Number
CS9511717
CL: Classification
SW 0840 Groundwater; Q2 02127 General papers on resources
SF: Subfile
Water Resources Abstracts; ASFA 2: Ocean Technology Policy & Non-Living Resources
AN: Accession Number
3730121

Record 127 of 153

TI: Title
Ecological impact of groundwater extraction on wetlands (Douro basin, Spain).
AU: Author
Bernaldez, FG; Ray Benayas, JM; Martinez, A
AF: Author Affiliation
Universidad Autonoma y Universidad Complutense, Madrid, Spain
CF: Conference
28th International Geological Congress Symposium on the Hydrogeology of Wetlands, Washigton, DC, USA, 07/89
SO: Source
Journal of Hydrology [J HYDROL.], vol. 141, no. 1-4, pp. 219-238, 1993
IS: ISSN
0022-1694

AB: Abstract
Declining water table levels in the Douro River basin, Central Spain are caused by the extraction of groundwater from a relatively homogeneous aquifer, and results in several types of impact on local wetlands which vary according to their characteristics. These wetlands are local, intermediate and regional groundwater discharge sites, seepages from post-Tertiary deposits, and non-linked ponds to groundwater dynamics. The following important factors influence the type of impact: the recharge or discharge nature of the affected sector of landscape; the type of connection with the regional aquifer; flow lengths and residence time of the water; the interaction between the water and the surface material, particularly clay. A wide range of wetland values and functions are affected according to the type of impact. The include productivity, amenity, recreational, scientific, educational and conservation values.
LA: Language
English
PY: Publication Year
1993
PT: Publication Type
Journal Article; Conference
DE: Descriptors
Groundwater; Ecology; Aquifers; Clay; Soils; Recharging (underground waters); Productivity; Rivers
ID: Identifiers
Ecological impact; Groundwater extraction; Wetlands; Douro River basin; Spain
CL: Classification
EE 444.1 Surface Water; EE 444.2 Groundwater; EE 454.3 Ecology and Ecosystems; EE 483.1 Soils and Soil Mechanics; EE 442.2 Land Reclamation
SF: Subfile
Environmental Engineering Abstracts
AN: Accession Number
0047170

Record 135 of 153

TI: Title
Simulated effects of development on regional ground-water/surface-water interactions in the northern coastal plain of New Jersey
AU: Author
Pucci, AA Jr; Pope, DA
AF: Author Affiliation
Dep. Civ. Environ. Eng., Lafayette Coll., Easton, PA 18920-1775, USA
SO: Source
Journal of Hydrology (Amsterdam) [J. HYDROL. (AMST.)], vol. 167, no. 1-4, pp. 241-262, 1995
IS: ISSN
0022-1694
AB: Abstract
Stream flow in the Coastal Plain of New Jersey is primarily controlled by ground-water discharge. Ground-water flow in a 400 square mile area (1035 km super(2)) of the Potomac-Raritan-Magothy aquifer system (PRMA) in the northern Coastal Plain of New Jersey was simulated to examine development effects on water resources. Simulations showed that historical development caused significant capture of regional ground-water discharge to streams and wetlands. The Cretaceous PRMA primarily is composed of fine to coarse sand, clays and silts which form the Upper and Middle aquifers and their confining units. The aquifer outcrops are the

principal areas of recharge and discharge for the regional flow system and have many traversing streams and surface-water bodies. A quasi-three-dimensional numerical model that incorporated ground-water/surface-water interactions and boundary flows from a larger regional model was used to represent the PRMA. To evaluate the influence of ground-water development on interactions in different areas, hydrogeologically similar and contiguous model stream cells were aggregated as 'stream zones'. The model representation of surface-water and ground-water interaction was limited in the areas of confining unit outcrops and because of this, simulated ground-water discharge could not be directly compared with base flow. Significant differences in simulated ground-water and surface-water interactions between the predevelopment and developed system, include; (1) redistribution of recharge and discharge areas; (2) reduced ground-water discharge to streams. In predevelopment, the primary discharge for the Upper and Middle aquifers is to low-lying streams and wetlands; in the developed system, the primary discharge is to ground-water withdrawals. Development reduces simulated ground-water discharge to streams in the Upper Aquifer from 61.4 to 10% of the Upper Aquifer hydrologic budget (28.9%, if impounded stream flow is included). Ground-water discharge to streams in the Middle Aquifer decreases from 80.0 to 22% of the Middle Aquifer hydrologic budget. The utility of assessing ground-water/surface-water interaction in a regional hydrogeologic system by simulation responses to development is demonstrated and which can compensate for lack of long-term stream-gaging data in determining management decisions.

LA: Language
English
SL: Summary Language
English
PY: Publication Year
1995
PT: Publication Type
Journal Article
DE: Descriptors
surface-groundwater relations; regional analysis; streamflow; groundwater discharge; aquifers; model studies; groundwater recharge; streams; hydrologic budget; groundwater management; water resources management; USA, New Jersey; environmental impact; land use; vegetation cover; development projects; ground water; water resources; regional planning
ER: Environmental Regime
Freshwater
TR: ASFA Input Center Number
CS9511955
CL: Classification
SW 0810 General; SW 2040 Groundwater management; SW 0840 Groundwater; Q5 01521 Mechanical and natural changes; Q2 02127 General papers on resources; P 2000 FRESHWATER POLLUTION
SF: Subfile
Water Resources Abstracts; ASFA 3: Aquatic Pollution & Environmental Quality; ASFA 2: Ocean Technology Policy & Non-Living Resources; Pollution Abstracts
AN: Accession Number
3734884

Record 136 of 153

TI: Title
Geochemistry and residence time estimation of groundwater from the upper aquifer of the Chihuahua desert (Comarca Lagunera, northern Mexico)

AU: Author
Brouste, L; Marlin, C; Dever, L
AF: Author Affiliation
Lab. d'Hydrologie et de Geochimie Isotopique, Bat. 504, Univ. de Paris-Sud, F-91405 Orsay Cedex, France
SO: Source
Applied Geochemistry [Appl. Geochem.], vol. 12, no. 6, pp. 775-786, Nov 1997
IS: ISSN
0883-2927
AB: Abstract
178 groundwater and surface waters have been sampled from April to September 1994 in an endoreic basin located in the N of Mexico (Comarca Lagunera). In this area, groundwater has been exploited over the past century mainly for irrigation and cattle supply. Recent intensive pumping has caused the lowering of the water table at a rate of 1 m a super(-1). Chemical analyses have been performed on all collected samples and 37 of them have been selected for isotopic measurements (super(18)O, super(2)H, super(13)C and super(14)C). Water stable isotope contents (super(18)O, super(2)H) show an increasing evaporation of the groundwater towards the Nazas river. They also indicate that the recharge occurs from the Nazas river and from the mountains surrounding the depression (Sierra Madre Occidental). Water presents a large spatial variability of the chemical facies (SO sub(4)-Ca, SO sub(4)-Cl-Na, HCO sub(3)-Ca and HCO sub(3)-Na) which is in relation with (i) their interaction with the geological formations of the basin (carbonates, gypsum and various silicates) and (ii) evaporation. This evaporation occurs in the upper part of the unsaturated zone during infiltration especially for the groundwater sampled near the Nazas river. The super(14)C activity varies between 110.4 (plus or minus 1.1) and 4.0 (plus or minus 0.2) pmc. The super(13)C contents of the total dissolved inorganic C (TDIC) range between -11.0 and -3.6ppt. The calculated super(13)C contents of the CO sub(2) in equilibrium with the TDIC, varying between -18.4ppt to -10.9ppt indicate two origins of C in solution: the carbonate matrix (delta super(13)C = +0.9ppt) and the soil CO sub(2) (delta super(13)C from -27.7ppt to -21.7ppt for the cultivated areas). Mean residence times have been determined after correction of the initial activities for dead C from the rock matrix. The mean residence times confirm a modern recharge of the groundwater from the Nazas and indicate the presence of palaeowaters in the northern and southern parts of the basin (up to 30 ka BP).
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1997
PD: Publication Date
19971100
PT: Publication Type
Journal Article
DE: Descriptors
Mexico, Comarca Lagunera, Chihuahua Desert; Mexico, Comarca Lagunera, Nazas R.; Stable Isotopes; Water Analysis; Spatial Distribution; Groundwater Recharge; Deserts; Geochemistry; Surface-groundwater Relations; Aquifers
ID: Identifiers
residence time
CL: Classification
SW 0810 General
UD: Update

199803
SF: Subfile
Water Resources Abstracts
AN: Accession Number
4256894

Record 139 of 153

TI: Title
Region 18, Alluvial Valleys
AU: Author
Rosenshein, JS
AF: Author Affiliation
Geological Survey Reston, VA
SO: Source
Hydrogeology. The Geological Society of North America, Boulder Colorado. 1988. p 165-175. 9 fig, 18 ref.
AB: Abstract
Alluvial-valley aquifer-stream systems form long narrow systems that occur in many parts of the conterminous United States and in Alaska and Canada. The alluvial-valley aquifers are in hydraulic connection with associated streams, and the systems are typified by the relatively rapid interaction of surface water and groundwater. Although the aquifer-stream systems are of limited areal extent in comparison to most aquifer systems, they are among the most intensively used and most historically important to people and their development, both culturally and economically. The hydrogeology of aquifer-stream systems reflects a complex depositional environment. However, based on gross depositional characteristics, the sediments making up the aquifer form permeable hydrogeological units that have, overall, a large hydraulic conductivity. (See also W90-02866) (Fish-PTT)
PY: Publication Year
1988
DE: Descriptors
Alluvial valley aquifers; Surface-groundwater relations; Geohydrology; Geohydrologic units; Alluvial aquifers; Geologic units; Geologic control; Groundwater movement; Geohydrologic boundaries; Streamflow; Streams; Water resources development; Deposition; Sediments; Permeability; Hydraulic conductivity; Alaska; Canada
CL: Classification
SW 0840 Groundwater
SF: Subfile
Water Resources Abstracts
AN: Accession Number
9002887

Record 148 of 153

TI: Title
Seepage into Variably Saturated Porous Medium
AU: Author
Tracy, JC; Marino, MA
AF: Author Affiliation
California Univ. Davis. Dept. of Land, Air and Water Resources
SO: Source
Journal of Irrigation and Drainage Engineering (ASCE) JIDEDH Vol. 113, No. 2, p 198-212, May 1987. 6 fig, 1 tab, 21 ref. ARS Cooperative agreement 4350-H.
AB: Abstract
A numerical model is developed for simulating the interaction of a surface water body with a variably saturated porous medium. A boundary condition simulating the soil-water pressure head at the

boundary between the porous medium and the surface water body, expressed as a function of the soil-water flux at the boundary, is also integrated into the model. The interaction of the surface and subsurface flow system leads to a more accurate simulation of soil-water flow velocity, which is of importance in problems dealing with the seepage of pollutants into the subsurface environment. The Galerkin-finite element method is used to solve the variably saturated flow equation and the Darcy equation, employing isoparametric elements that simulate the physical geometry of the porous medium. Solutions to the model give the transient position of the stage of the surface water body and the distribution of the phreatic surface in the porous medium, providing robust estimates of the rate of seepage into the porous medium. The capability of the model is illustrated by considering the interaction of a semipervious surface pond with a variably saturated stream-aquifer system. (Author 's abstract)

PY: Publication Year
1987

DE: Descriptors
Infiltration; Surface-groundwater relations; Soil water movement; Unsaturated flow; Aquifers; Model studies; Seepage; Porous media; Saturation; Simulation; Path of pollutants; Surface water; Boundary conditions; Subsurface flow; Equations

CL: Classification
SW 0845 Water in soils; SW 3020 Sources and fate of pollution

SF: Subfile
Water Resources Abstracts

AN: Accession Number
8708584

Record 149 of 153

TI: Title
Hydrology of a Headwater Basin Wetland: Groundwater Discharge and Wetland Maintenance

AU: Author
Roulet, NT

AF: Author Affiliation
York Univ

SO: Source
Hydrological Processes HYPRE3, Vol. 4, No. 4, p 387-400, October/December 1990. 10 fig, 20 ref.

AB: Abstract
The link between groundwater and surface hydrology in a small headwater drainage basin in the zone of glacial deposition of southern Ontario south of the Precambrian Shield was examined for two years. The basin is situated in a discharge zone of a regional aquifer and contains a small treed spring-fed swamp. The swamp exists because of the groundwater and has little effect on the maintenance of streamflow. Groundwater input to the swamp is an order of magnitude larger than precipitation. Groundwater of local and regional origin passes through the swamp by two routes: surface streamlets, where groundwater that emerges at specific seepage points in the swamp is conveyed over the ground surface with little interaction with the swamp itself , and by diffuse seepage in the swamp and through the bed of the stream. While the diffuse seepage input is the smaller component of groundwater it maintains the swamp 's saturation. Groundwater input to the swamp from the specific seepage-points and diffuse flow varies little over a year; therefore the saturation of the swamp and baseflow from the basin display little seasonal variation compared to other wetland types. The existence of the valley bottom in the headwater basin alters the seasonal and storm hydrology and is important to biogeochemical transformation of emerging groundwater. (Author 's

abstract)
PY: Publication Year
1990
DE: Descriptors
Groundwater movement Seepage springs Surface-groundwater; relations Swamps Wetlands Aquifers Headwaters Ontario
CL: Classification
SW 0850 Lakes; SW 0840 Groundwater
SF: Subfile
Water Resources Abstracts
AN: Accession Number
9104106

Record 152 of 153

TI: Title
Seasonal Dynamics of Groundwater-Lake Interactions at Donana National Park, Spain
AU: Author
Sacks, LA; Herman, JS; Konikow, LF; Vela, AL
SO: Source
Journal of Hydrology JHYDA7, Vol. 136, No. 1/4, p 123-154, August 1992. 10 fig, 4 tab, 32 ref.
AB: Abstract
The hydrologic and solute budgets of a lake can be strongly influenced by transient groundwater flow. Several shallow interdunal lakes in southwest Spain are in close hydraulic connection with the shallow groundwater. Two permanent lakes and one intermittent lake have chloride concentrations that differ by almost an order of magnitude. A two-dimensional solute-transport model, modified to simulate transient groundwater-lake interaction, suggests that the rising water table during the wet season leads to local flow reversals toward the lakes. Response of the individual lakes, however, varies depending on the lake's position in the regional flow system. The most dilute lake is a flow-through lake during the entire year; the throughflow is driven by regional groundwater flow. The other permanent lake, which has a higher solute concentration, undergoes seasonal groundwater flow reversals at its downgradient end, resulting in complex seepage patterns and higher solute concentrations in the groundwater near the lake. The solute concentration of the intermittent lake is influenced more strongly by the seasonal wetting and drying cycle than by the regional flow system. Although evaporation is the major process affecting the concentration of conservative solutes in the lakes, geochemical and biochemical reactions influence the concentration of nonconservative solutes. Probable reactions in the lakes include biological uptake of solutes and calcite precipitation; probable reactions as lake water seeps into the aquifer are sulfate reduction and calcite dissolution. Seepage reversals can result in water composition that appears inconsistent with predictions based on head measurements because, under transient flow conditions, the flow direction at any instant may not satisfactorily depict the source of the water. (Author's abstract)
PY: Publication Year
1992
DE: Descriptors
*Groundwater movement; *Hydrologic budget; *Lakes; *Model studies; *Spain; *Surface-groundwater relations; Biochemistry; Chlorides; Flow models; Geochemistry; Groundwater chemistry; Hydrodynamics; Hydrologic cycle; Intermittent lakes; Path of pollutants; Seasonal variation; Seepage; Shallow aquifers; Solute transport; Water chemistry; Water table gradient; Water table rise
CL: Classification

SW 0840 Groundwater; SW 0850 Lakes
SF: Subfile
Water Resources Abstracts
AN: Accession Number
9303388

Record 153 of 153

TI: Title
Numerical Simulation of Groundwater Flow in Fuhrberg Field, Hanover
AU: Author
Hoffmann, B; Rai, SN
AF: Author Affiliation
National Geophysical Research Inst
SO: Source
Appropriate Methodologies for Development and Management of Groundwater Resources in Developing Countries. Proceedings of an International Workshop held February 28-March 4, 1989. This is Volume 2 of a 3 Volume Set. A. A. Balkema, Brookfield, Vermont. 1989. p 595-606, 6 fig, 1 tab, 6 ref.
AB: Abstract
Groundwater is the main source of water supply to Hanover City (Germany); much of it is obtained from Fuhrberg field. A mathematical model was employed to simulate dynamic behavior of the water table in response to recharge, pumpage, and interaction with a river in Fuhrberg field. An area of 372 sq km , with a maximum extension of 26 km (E-W) by 18 km (N-S) was considered in the analysis. Water balance analysis was conducted for a period of 14 yr and the model was used to predict the spatio-temporal distribution of the water table in response to proposed pumping and artificial recharge schemes. Based on use of the model, the following conclusions were drawn: (1) good agreement exists between computed and measured water table heights, confirming the validity of the model for simulation in this study area; (2) groundwater flow during the period of investigation (April 1968 through April 1982) exhibited a state of balance; and (3) prediction results indicate an increase in aquifer storage, which leads to a rise in the water table. (See also W91-03311) (Rochester-PTT)
PY: Publication Year
1989
DE: Descriptors
Germany Groundwater movement Model studies Numerical analysis; Simulation Water table fluctuations Hydrologic budget; Mathematical models Prediction Spatial distribution Temporal; distribution Water level fluctuations
CL: Classification
SW 0840 Groundwater; SW 0890 Estuaries; SW 2040 Groundwater management
SF: Subfile
Water Resources Abstracts
AN: Accession Number
9103320

Cambridge Scientific Abstracts
Database: Environmental Sciences and Pollution Mgmt
Query: kw=((ground and water) or groundwater) and ((surface and water) or surfacewater) and (interaction or integrated or coupled)
Your Comments: From CSA in Enviornmental Sciences and Pollution Management

Record 2 of 145

TI: Title
Simulation of and ground water systems -
Model formulation
AU: Author
Yan, Jiansheng; Smith, KR
AF: Author Affiliation
Hydrogeol., Div., South Florida Water Manage. District, 3301 Gun Club Rd., P.O. Box 24680, West Palm Beach, FL 33416-4680, USA
SO: Source
Water Resources Bulletin [WATER RESOUR. BULL.], vol. 30, no. 5, pp. 879-890, 1994
IS: ISSN
0043-1370
AB: Abstract
The unique characteristics of the hydrogeologic system of south Florida (flat topography, sandy soils, high water table, and highly developed canal system) cause significant interactions between ground water and surface water systems. Interaction processes involve infiltration, evapotranspiration (ET), runoff, and exchange of flow (seepage) between streams and aquifers. These interaction processes cannot be accurately simulated by either a surface water model or a ground water model alone because surface water models generally oversimplify ground water movement and ground water models generally oversimplify surface water movement. Estimates of the many components of flow between surface water and ground water (such as recharge and ET) made by the two types of models are often inconsistent. The inconsistencies are the result of differences in the calibration components and the model structures, and can affect the confidence level of the model application. In order to improve model results, a framework for developing a model which integrates a surface water model and a ground water model is presented. Dade County, Florida, is used as an example in developing the concepts of the integrated model. The conceptual model is based on the need to evaluate water supply management options involving the conjunctive use of surface water and groundwater, as well as the evaluation of the impacts of proposed wellfields. The mathematical structure of the integrated model is based on the South Florida Water Management Model (SFWMM) (MacVicar et al., 1984) and A Modular Three-Dimensional Finite-Difference Groundwater Flow Model (MODFLOW) (McDonald and Harbaugh, 1988).
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1994
PT: Publication Type
Journal Article
DE: Descriptors
simulation; surface-groundwater relations; model studies; geohydrology; infiltration; evapotranspiration; runoff; seepage; USA, Florida
CL: Classification
SW 0810 General; SW 5080 Evaluation, processing and publication
SF: Subfile
Water Resources Abstracts

AN: Accession Number
3712381

Record 3 of 145

TI: Title
Interaction process between surface water and ground water - advanced evaluations for the Neuwied Basin.
OT: Original Title
Zum Austauschvorgang zwischen Fluss- und Grundwasser - Weitergehende Auswertungen aus dem Neuwieder Beckeh
AU: Author
Giebel, H; Hommes, A
SO: Source
Deutsche Gewasserkundliche Mitteilungen. Koblenz [DTSCH. GEWAESSERKD. MITT.], vol. 32, no. 1-2, pp. 18-27, 1988
IS: ISSN
0012-0235
AB: Abstract
Evaluations of a six-year measurement series on ground-water levels at a measuring profile perpendicular to the Rhine in the Neuwied basin at Urmitz have led to the results described in the paper. With the aid of a volume calculation field method applied by Ubell, the interchange processes between stream and ground water were investigated on the basis of single flood events and in the temporal sequence of 24 months. Calculations on the extent and duration of the changes in volumes of ground water in storage and of bank storage are presented.
LA: Language
German
SL: Summary Language
German; English
PY: Publication Year
1988
PT: Publication Type
Journal Article
DE: Descriptors
surface water; storage; fluid mechanics; hydrology; groundwater
CL: Classification
P 2000 FRESHWATER POLLUTION
SF: Subfile
Pollution Abstracts
AN: Accession Number
1956373

Record 4 of 145

TI: Title
System Modelling of the Interaction Between Surface and Ground Waters in Problems of Hydrology
AU: Author
Vasiliev, OF
AF: Author Affiliation
Institut Gidrodinamiki Novosibirsk (USSR)
SO: Source
Hydrological Sciences Journal HSJODN Vol. 32, No. 3, p 297-311, September 1987. 4 fig, 36 ref.

AB: Abstract
A survey of the mathematical (quantitative) modeling of the interaction between surface water and groundwater is presented. Besides describing the existing approach to such modeling and the main difficulties in its realization, a brief review of the principal works on the subject under consideration, including Soviet ones is presented. The construction of such coupled models requires the development of methods of conjunction between models which represent surface and subsurface flows, which describe the different processes of water transfer and transformation constituting the hydrological cycle, and which include the different components of hydrological, hydrogeological and water management systems (water bodies, streams, aquifers, etc.). Such models are of different complexities and have different dimensionality in space variables. The characteristic time scales of transient processes for surface water and groundwater differ greatly, and this is of profound importance in the numerical modelling of their interconnected motion. (Author 's abstract)
PY: Publication Year
1987
DE: Descriptors
Surface-groundwater relations; Hydrologic models; Model studies; Mathematical models; Hydrological systems; Flow profiles; Geohydrology; Water management; Mathematical studies
CL: Classification
SW 0810 General; SW 0840 Groundwater
SF: Subfile
Water Resources Abstracts
AN: Accession Number
8801962

Record 6 of 145

TI: Title
Importance of surface-ground water interaction to Corps total water management: Regional and national examples
AU: Author
Johnson, WK
CA: Corporate Author
Hydrologic Engineering Cent., Davis, CA (USA)
SO: Source
RES. REP. HYDROL. ENG. CENT. DAVIS CA, 1991, 37 pp
NT: Notes
NTIS Order No.: AD-A236 079/0/GAR.
NU: Other Numbers
HEC-RD-32
AB: Abstract
In this report specific regional and national examples are described where surface and ground water are integral to the Corps of Engineers water control responsibilities. Each example includes a brief description, illustrative figures, and technical references. The references provide technical depth not present in the descriptions or figures. The regions covered by the examples are selected to provide a broad geographical distribution throughout the country. Two national examples are cited: wetlands, where discharge and recharge occur between surface and ground water, and Army installations where environmental restoration is

focused on preventing surface contaminants from polluting underlying ground water supplies. (DBO)
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1991
PT: Publication Type
Report
DE: Descriptors
surface water; ground water; interactions; water management; national planning; pollution control; environmental protection; groundwater pollution; USA
ID: Identifiers
Army Corps of Engineers
ER: Environmental Regime
Freshwater
TR: ASFA Input Center Number
NO9502161
CL: Classification
Q5 01505 Prevention and control
SF: Subfile
ASFA 3: Aquatic Pollution & Environmental Quality
AN: Accession Number
3758598

Record 7 of 145

TI: Title
Isotope-aided study on the interaction of surface water and groundwater
AU: Author
Ahn, JS; Kim, JH; Yun, ST; Jeong, CH; Kim, KN
CA: Corporate Author
Korea Advanced Energy Research Inst., Daeduk (Rep. of Korea)
SO: Source
KAERI/RR-612/87, , 1987, 78 pp
NT: Notes
NTIS Order No.: DE88705874/GAR.
NU: Other Numbers
KAERI/RR-612/87
AB: Abstract
The interaction between surface water and groundwater was studied by isotope-aided techniques in the vicinity of the KAERI area. The understanding of surface water and groundwater flow systems and the analysis of geomaterials which provide the pathway of groundwater is important for the hydrogeological safety assessment of the radioactive waste disposal. The results of the analyses of environmental isotopes have shown that the shallow groundwater in this area was originated from the meteoric water which is infiltrated rapidly into the subsurface materials. The higher content of the environmental isotopes in some groundwater samples indicate that this anomalous values is attributed to impermeable, fine-grained materials. Also, the results of hydrochemical analyses of water samples indicate that shallow groundwater and precipitation are well mixed. (DBO)

LA: Language
Korean
SL: Summary Language
English
PY: Publication Year
1987
PT: Publication Type
Report
DE: Descriptors
geochemistry; surface water; ground water; hydrology; environmental impact; pollution dispersion; radioactive wastes; waste disposal sites
ER: Environmental Regime
Freshwater
TR: ASFA Input Center Number
NO9500880
CL: Classification
Q2 02181 General; Q5 01503 Characteristics, behavior and fate
SF: Subfile
ASFA 2: Ocean Technology Policy & Non-Living Resources; ASFA 3: Aquatic Pollution & Environmental Quality
AN: Accession Number
3679819

Record 8 of 145

TI: Title
The chemical regime and interaction of surface- and groundwater in the Small Carpathian region
AU: Author
Pekarova, P; Pekar, J
AF: Author Affiliation
Institute of Hydrology of the Slovak Academy of Sciences, Racianska 75, 830 08 Bratislava, The Slovak Republic
SO: Source
Ekologia (Bratislava)/Ecology (Bratislava) [Ekologia (Bratisl.)/Ecology (Bratisl.)], vol. 17, no. 4, pp. 391-406, 1998
IS: ISSN
1335-342X
AB: Abstract
The paper deals with the following subjects: 1. Statistical evaluation of rain-, surface-, and groundwater quality data in the Small Carpathian region. 2. Analysis of chemical regime of surface water in this region. 3. Analysis of interaction between surface- and groundwater in Trnavka brook catchment. The analysis was based on the data monitored by the Institute of Hydrology of the Slovak Academy of Sciences (IH SAS) weekly (fortnightly) during the period 1991-1995. In the samples of rain-, surface- and groundwater, the following chemicals were analysed: nitrate, nitrite, ammonium, sulphate, chloride, phosphate, as well as pH.
LA: Language
English
SL: Summary Language
English; Slovak
PY: Publication Year
1998
PD: Publication Date

19980000
PT: Publication Type
Journal Article
DE: Descriptors
Ground water; Surface water; Water chemistry; Europe; Slovak Rep.; Surface-groundwater Relations; Geochemistry; Chemical Analysis; Chemistry of Precipitation; Rainfall
CL: Classification
D 04600 Soil; SW 0880 Chemical processes
UD: Update
199903
SF: Subfile
Ecology Abstracts; Water Resources Abstracts
AN: Accession Number
4441504

Record 9 of 145

TI: Title
Surface water and ground water interaction -- Part 1.
OT: Original Title
Austauschvorgaenge zwischen Fluss- und Grundwasser -- Teil 1
AU: Author
Ubell, K
SO: Source
Deutsche Gewasserkundliche Mitteilungen. Koblenz [DTSCH. GEWAESSERKD. MITT.], vol. 31, no. 4, pp. 119-125, 1987
IS: ISSN
0012-0235
AB: Abstract
The paper describes, by the example of the Neuwied basin, the interchange processes between the Rhine and ground water. The so called bank storage, indicative of the changes of ground water in storage due to a flood wave, is determined as water volume and as rate of inflow and outflow from and into the Rhine, respectively.
LA: Language
German
SL: Summary Language
German; English
PY: Publication Year
1987
PT: Publication Type
Journal Article
DE: Descriptors
groundwater; surface water; basins; flow rates
CL: Classification
P 2000 FRESHWATER POLLUTION
SF: Subfile
Pollution Abstracts
AN: Accession Number
1611588

Record 10 of 145

TI: Title
Surface water and ground water interaction - Part II.
OT: Original Title

Austauschvorgaenge zwischen fluss- und Grundwasser - Teil II
AU: Author
Ubell, K
AF: Author Affiliation
Bundesanst. Gewaesserkd., Postfach 389, 5400 Koblenz, FRG
SO: Source
Deutsche Gewasserkundliche Mitteilungen. Koblenz [DTSCH. GEWAESSERKD. MITT.], vol. 31, no. 5, pp. 142-148, 1987
IS: ISSN
0012-0235
AB: Abstract
The interchange between ground water and stream under alternating effluent and influent conditions is an unsteady flow process that is governed by the variations in river stages. In representing the interrelation between stream and ground water with the aid of hydrographs, the usual procedure is mostly confined to the temporal development of ground-water levels in conjunction with the river stages. A quantitative determination of water exchange, i.e., an assessment of variations of ground water in storage due to a flood wave has, so far as is known, seldom been attempted up to the present.
LA: Language
German
SL: Summary Language
German; English
PY: Publication Year
1987
PT: Publication Type
Journal Article
DE: Descriptors
surface water; groundwater; fluid mechanics; hydrology
CL: Classification
P 2000 FRESHWATER POLLUTION
SF: Subfile
Pollution Abstracts
AN: Accession Number
1685804

Record 11 of 145

TI: Title
Incorporating the interaction between surface flow and groundwater into a mathematical model of selecting optimal parameters of water management systems
AU: Author
Minkin, EL; Khranovich, IL
AF: Author Affiliation
Water Problems Inst., Russian Acad. Sci., ul. Novaya Basmannaya 10, Moscow 107078, Russia
SO: Source
WATER RESOUR.; VODNYE RESURSY, vol. 23, no. 3, pp. 347-353; vol. 23, no. 3, pp. 376-382, Jun 1996
IS: ISSN
0097-8078
AB: Abstract
A flow model is suggested for selecting optimal parameters of a water management system (WMS); the model incorporates conditions

reflecting the interaction between surface flow and groundwater. Introduction of groundwater deposits into the model, with allowance made for their interaction with surface flow, is based on the effect the regime of their development produces on the surface flow and on the regime of replenishment of resources; this effect is accounted for in the model in the form of a stationary linear system. The groundwater deposits are represented in the model as fragments of a network comprising nodes, where stores, sources, and sinks are located, as are edges which reflect the links with the rest of the network. Thus, the class of flow models intended to substantiate the parameters of WMS is extended.

LA: Language
English
SL: Summary Language
English
PY: Publication Year
1996
PT: Publication Type
Journal Article
DE: Descriptors
mathematical models; surface water; groundwater; water management; surface-groundwater relations; groundwater mining; water budget; ground water
ID: Identifiers
mathematical models
TR: ASFA Input Center Number
CS9702500
CL: Classification
SW 0810 General; Q2 02171 Dynamics of lakes and rivers
SF: Subfile
Water Resources Abstracts; ASFA 2: Ocean Technology Policy & Non-Living Resources
AN: Accession Number
3991167

Record 12 of 145

TI: Title
Coupled use of thermal and hydraulic head data to characterize river-groundwater exchanges
AU: Author
Doussan, C; Toma, A; Paris, B; Poitevin, G; Ledoux, E; Detay, M
AF: Author Affiliation
Cent. Inf. Geol., Ecol. Mines de Paris, 35 rue Saint-Honore, 77305 Fontainebleau, Cedex, France
SO: Source
Journal of Hydrology (Amsterdam) [J. HYDROL. (AMST.)], vol. 153, no. 1-4, pp. 215-229, 1994
IS: ISSN
0022-1694
AB: Abstract
Bank filtration is often used for the production of drinking water from alluvial aquifers. In this paper we present a model of river bank filtration for a case test study of a well field located in France. The inverse approach and the conjunctive use of piezometric and thermal data bring to light the importance and the heterogeneity of the banks on the filtration. An example of

chloride tracer transport is given and the influence of the clogging of the bank on the filtration of pollutants is presented.
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1994
PT: Publication Type
Journal Article
DE: Descriptors
river banks; ground water; seepages; hydraulic models; exchange capacity; groundwater; surface-groundwater relations; rivers; banks; filtration; drinking water
ID: Identifiers
infiltration
ER: Environmental Regime
Freshwater
TR: ASFA Input Center Number
CS9407752
CL: Classification
Q2 02161 General; SW 0810 General; SW 0840 Groundwater
SF: Subfile
ASFA 2: Ocean Technology Policy & Non-Living Resources; Water Resources Abstracts
AN: Accession Number
3553691

Record 13 of 145

TI: Title
Simulation of integrated surface water and ground water systems - model formulation
AU: Author
Yan, J; Smith, KR
AF: Author Affiliation
South Florida Water Management District, West Palm Beach, FL, USA
SO: Source
Water Resources Bulletin [WATER RESOUR BULL], vol. 30, no. 5, pp. 879-890, 1994
IS: ISSN
0043-1370
PB: Publisher
AMERICAN WATER RESOURCES ASSOC, BETHESDA, MD, (USA)
AB: Abstract
A framework for developing a model which integrates a surface water model and a ground water model is presented. Date County, Florids, is used as an example in developing the concepts of the integrated model. The conceptual model is based on the need to evaluate water supply management options involving the conjunctive use of surface water and groundwater as well as the evaluation of the impacts of the proposed wellfields.
LA: Language
English
PY: Publication Year
1994
PT: Publication Type

Journal Article
DE: Descriptors
Mathematical models; Surface waters; Groundwater; Numerical methods; Industrial management; Water resources
ID: Identifiers
Integrated water systems; Numerical models; Florida; Hydrogeology
CL: Classification
EE 446.1 Water Supply Systems; EE 921 Applied Mathematics; EE 441.1 Dams; EE 441.2 Reservoirs; EE 912.2 Management
SF: Subfile
Environmental Engineering Abstracts
AN: Accession Number
0176404

Record 14 of 145

TI: Title
Application of an integrated basin-scale hydrologic model to simulate surface-water and ground-water interactions
AU: Author
Yu, Zhongbo; Schwartz, FW
AF: Author Affiliation
Earth System Science Center, The Pennsylvania State University, 248 Deike Bldg., University Park, PA 16802, USA; E-mail: yu@essc.psu.edu
SO: Source
Journal of the American Water Resources Association [J. Am. Water Resour. Assoc.], vol. 34, no. 2, Apr 1998
IS: ISSN
1093-474X
AB: Abstract
Hydrologic models have become an indispensable tool for studying processes and water management in watersheds. A physically-based, distributed-parameter model, Basin-Scale Hydrologic Model (BSHM), has been developed to simulate the hydrologic response of large drainage basins. The model formulation is based on equations describing water movement both on the surface and in the subsurface. The model incorporates detailed information on climate, digital elevation, and soil moisture budget, as well as surface-water and ground-water systems. This model has been applied to the Big Darby Creek Watershed, Ohio in a 28-year simulation of rainfall-runoff processes. Unknown coefficients for controlling runoff, storativity, hydraulic conductivity, and streambed permeability are determined by a trial-and-error calibration. The performance of model calibration and predictive capability of the model was evaluated based on the correlation between simulated and observed daily stream discharges. Discrepancies between observed and simulated results exist because of limited precipitation data and simplifying assumptions related to soil, land use, and geology.
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1998
PD: Publication Date

19980400
PT: Publication Type
Journal Article
DE: Descriptors
Surface-groundwater Relations; Hydrologic Models; Land Use; Geology; Watersheds; Performance Evaluation; Groundwater Movement; Runoff; Permeability Coefficient
CL: Classification
SW 0810 General; SW 0840 Groundwater
UD: Update
199807
SF: Subfile
Water Resources Abstracts
AN: Accession Number
4316143

Record 16 of 145

TI: Title
Development of Integrated Surface and Ground Water Management in Illinois
AU: Author
Crandall, DA
AF: Author Affiliation
Illinois State Environmental Protection Agency Springfield. Div. of Land Pollution Control
SO: Source
Options for Reaching Water Quality Goals, Proceedings of the Twentieth Annual Conference of the American Water Resources Association Symposium, Washington, DC. August 15, 1984. 1985. p 193-199, 7 fig, 8 ref.
AB: Abstract
The Illinois Environmental Protection Agency carried out a multi-year effort to study the integration of surface and groundwater management. Five studies in this national prototype project under Section 208 of the Federal Water Pollution Control Act were funded at the Illinois State Water Survey, the Illinois State Geological Survey and in-house to understand better the technical aspects of surface and groundwater interrelationships. These studies developed: (1) information on the discharge of groundwater from facilities with NPDES permits; (2) maps of groundwater quality and a study relating the mapped data to surface water quality for the Mackinaw River Basin; (3) information relating oil field brine and surface water quality; (4) a detailed survey of information related to surface and groundwater management in the Sangamon River Basin; and (5) state-wide maps of aquifer susceptibility to contamination. An additional study involved an institutional assessment of groundwater management. Information developed in the technical studies provided a basis for including measures relating surface and groundwater management in the proposed groundwater strategy for Illinois. Specific measures developed in the proposed strategy include delineation of critical recharge areas and imminent return-flow areas. (See also W87-06270) (Author 's abstract)
PY: Publication Year
1985
DE: Descriptors

Water quality control; Illinois; Groundwater pollution; Water pollution control; Surface-groundwater relations; Surface water; Water quality management; Groundwater quality
CL: Classification
SW 2040 Groundwater management; SW 2010 Control of water on the surface; SW 3070 Water quality control
SF: Subfile
Water Resources Abstracts
AN: Accession Number
8706291

Record 18 of 145

TI: Title
Ground-water and stream-water interaction in the Owl Creek Basin, Wyoming
AU: Author
Ogle, KM
SO: Source
USGS Water-Resources Investigations Report, USGS, 1996, 23 pp
NT: Notes
Available from USGS, Branch of Information Services, USGS Open-File Reports Section, Box 25286, MS 517, Denver Federal Center, Denver, CO 80225 (USA)
PB: Publisher
USGS
NU: Other Numbers
96-4253
AB: Abstract
Understanding of the interaction of ground-water and surface-water resources is vital to water management when water availability is limited. Inflow of ground water is the primary source of water during stream base flow. The water chemistry of streams may substantially be affected by that inflow of ground water. This report is part of a study to examine ground-water and surface-water interaction in the Owl Creek Basin, Wyoming, completed by the U.S. Geological Survey in cooperation with the Northern Arapaho Tribe and the Shoshone Tribe. During a low flow period between November 13 - 17, 1991, streamflow measurements and water-quality samples were collected at 16 selected sites along major streams and tributaries in the Owl Creek Basin, Wyoming. The data were used to identify stream reaches receiving ground-water inflow and to examine causes of changes in stream chemistry. Streamflow measurements, radon-222 activity load and dissolved solids load were used to identified stream reaches receiving ground-water inflow. Streamflow measurements identified three stream reaches receiving ground-water inflow. Analysis of radon-222 activity load identified five stream reaches receiving ground-water inflow. Dissolved solids load identified six stream reaches receiving ground-water inflow. When these three methods were combined, stream reaches in two areas, the Embar Area and the Thermopolis Anticline Area, were identified as receiving ground-water inflow. The Embar Area and the Thermopolis Anticline Area were then evaluated to determine the source of increased chemical load in stream water. Three potential sources were analyzed: tributary inflow, surficial geology and anticlines. Two sources, tributary inflow and surficial geology, were related to

changes in isotopic ratios and chemical load in the Embar Area. In two reaches in the Embar Area, isotopic ratios of 18O/16O, D/H and 34S/32S indicated that tributary inflow affected stream-water chemistry. Increased chemical load of dissolved solids and dissolved sulfate in North Fork and South Fork Owl Creek appear to be related to the percentage of unconsolidated Quaternary deposits and of Cretaceous-Jurassic deposits in the drainage area. In the Thermopolis Anticline Area, changes in water chemistry in Owl Creek were not related to tributary inflow, surficial geology, or anticlines. The three tributaries that flow into Owl Creek in the Thermopolis Anticline Area did not substantially affect the isotopic ratios or contribute to the chemical load. Changes in the chemical load were not associated with changes in the surficial geology between the stream-water sampling sites. Water levels and chemical ratios indicate no ground-water inflow from the Thermopolis Anticline geothermal system to Owl Creek.

LA: Language
English
SL: Summary Language
English
PY: Publication Year
1996
PD: Publication Date
19960000
PT: Publication Type
Report
DE: Descriptors
USA, Wyoming; Low Flow; Catchment Areas; Streamflow; Water Sampling; Groundwater; Base Flow; Water Quality; Surface-groundwater Relations; Isotope Studies
CL: Classification
SW 0810 General
UD: Update
199803
SF: Subfile
Water Resources Abstracts
AN: Accession Number
4241242

Record 22 of 145

TI: Title
Interaction of Lake Michigan with a layered aquifer stressed by drainage
AU: Author
Cherkauer, DS; Carlson, DA
AF: Author Affiliation
Dep. Geosciences, Univ. Wisconsin-Milwaukee, P.O. Box 413, Milwaukee, WI 53201, USA
SO: Source
Ground Water [GROUND WATER], vol. 35, no. 6, pp. 981-989, Dec 1997
IS: ISSN
0017-467X
NT: Notes
Contact: Ground Water Publishing Co., 6375 Riverside Dr., Dublin, OH 43017 (USA). PH: (800) 332-2104. FAX: (614) 761-3446.
AB: Abstract

Ground-water interaction with lakes is often difficult to document because of both its diffusiveness and its spatial and temporal variability; reproducible measurements can he difficult to obtain. This paper takes advantage of the construction of a major drain stress in an aquifer system proximal to Lake Michigan to examine ground-water/lake interactions in a complex hydrogeological setting. At the time of the measurements, the tunnel (4 to 8 m in diameter, 13 km in length, 1 to 3 km inland, and constructed in a low conductivity unit within a layered, fractured dolomite aquifer) had produced drawdowns of up to 50 m in the aquifer. In turn, the resulting trough of depression was inducing over 1600 m super(3)/day (425,000 gpd) of water to flow from the lake to the tunnel. Seepage meters have been deployed over 40 km super(2) of the lake bed to define the extent of the tunnel's impact. The results show that seepage through the lake bed is a combination of downward flow toward the tunnel and lateral inflow generated by recharge events in shallow unconsolidated sediments. Downward seepage is detectable to more than 2 km offshore, so an average of over 20 m of clay-rich glacial deposits and 10 m of dolomitic shale (both with hydraulic conductivities < 3 x 10 super(-8) m/sec) does not isolate the lake from the aquifer. Seepage meters have proven to be a viable and cost-effective means to provide an accurate spatial distribution of ground-water/lake exchanges over a large area.

LA: Language
English
SL: Summary Language
English
PY: Publication Year
1997
PD: Publication Date
19971200
PT: Publication Type
Journal Article
DE: Descriptors
USA, Michigan L.; Surface-groundwater Relations; Aquifer Systems; Tunnels; Seepage; Spatial Distribution; Subsurface Drainage; Stress; Drawdown; Ground water; Hydrology; USA, Michigan L.
ER: Environmental Regime
Freshwater
TR: ASFA Input Center Number
CS9801778
CL: Classification
SW 0810 General; SW 0840 Groundwater; Q2 02171 Dynamics of lakes and rivers
UD: Update
199802
SF: Subfile
Water Resources Abstracts; ASFA 2: Ocean Technology Policy & Non-Living Resources
AN: Accession Number
4228143

Record 25 of 145

TI: Title
Suggestion for a coupled model of surface and groundwater

simulation on a watershed.
OT: Original Title
Proposition d'un modele couple pour la simulation conjointe des ecoulements de surface et des ecoulements souterrains sur un bassin hydrologique
AU: Author
Ledoux, E; Girard, G; Villeneuve, JP
AF: Author Affiliation
Eco. Mines Paris, Cent. Inf. Geol., France
SO: Source
Houille blanche. Grenoble [HOUILLE BLANCHE.], no. 1-2, pp. 101-110, 1984
IS: ISSN
0018-6368
AB: Abstract
This article describes an integrated modelling method for surface water and groundwater flow in a drainage area based on a breakdown of the water cycle in spatial terms. Theoretical principles with respect to the way the model's structure was computed, calculation of the groundwater inventory at ground level, run-off to the insaturated zone and associated surface and subsurface flow patterns are all examined. An example of practical application is then given based on the Caramy drainage area in the South of France. In this case it is shown how the coupled model can be applied to a structure which has very heterogeneous physiographical and hydrological characteristics.
LA: Language
French
SL: Summary Language
German; English; Spanish; French
PY: Publication Year
1984
PT: Publication Type
Journal Article
DE: Descriptors
groundwater; simulation; watersheds; surface water; mathematical models; hydrology
CL: Classification
P 2000 FRESHWATER POLLUTION; C CA15.2 GEOLOGY
SF: Subfile
Pollution Abstracts; Computer and Information Systems Abstracts
AN: Accession Number
0955696

Record 27 of 145

TI: Title
Quality of ground water around Vadnais Lake and in Lambert Creek watershed, and interaction of ground water with Vadnais Lake, Ramsy County, Minnesota
AU: Author
Ruhl, JF
SO: Source
U.S. GEOL. SURVEY, EARTH SCIENCE INFORMATION CENTER, OPEN-FILE REPORTS SECTION, BOX 25286, MS 517, DENVER, CO 80225 (USA), 1994, 59 pp
NT: Notes

USGS Water-Resources Investigations Report: 94-4062.
PB: Publisher
U.S. GEOL. SURVEY, EARTH SCIENCE INFORMATION CENTER, OPEN-FILE REPORTS SECTION, BOX 25286, MS 517, DENVER, CO 80225 (USA)
AB: Abstract
Vadnais Lake, located in Ramsey County, Minnesota, is used by the St. Paul Water Utility for storage of municipal water supplies. In recent years algal blooms in Vadnais Lake have caused taste and odor problems in the water. Phosphorus enrichment in the lake is potentially a significant contributing factor in the algal growth. Surface-water drainage from wetlands in Lamberts Creek watershed, which extends over 20 square miles to the east of the lake, is known to be a significant source of the phosphorus during wet years. Results of this study indicate that groundwater does not transport large concentrations of phosphorus into Vadnais Lake. Seepage into and out of Vadnais Lake was estimated by the following methods: (1) interpretation of the hydraulic conductivities of glacial deposits around the lake and of the hydraulic gradients between ground water in these deposits and the lake, and (2) interpretation of the hydraulic conductivities of lake-bed materials and of the hydraulic gradients between ground water in the lake bed and the lake. The estimated net annual seepage out of the lake determined by the second method was 9.56 x 10 cu ft per year, which exceeded by an order of magnitude the value determined by the first method, of 2.82 x 10 super(6) cu ft per year. The net seepage out of the lake is a very small component of the lake water budget. Inflow to Vadnais Lake is mostly streamflow from Sucker Creek, which is largely water from the Mississippi River routed through a series of lakes, and outflow from the lake is mostly withdrawals by the St. Paul Water Utility.
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1994
PT: Publication Type
Report
DE: Descriptors
USA, Minnesota, Ramsey Cty.; municipal water; water storage; lakes; eutrophication; phosphorus; seepage; groundwater; limnology; surface-groundwater relations
CL: Classification
SW 0810 General
SF: Subfile
Water Resources Abstracts
AN: Accession Number
3799633

Record 28 of 145

TI: Title
Analytical Ground-Water Flow Solutions for Channel-Aquifer Interaction
AU: Author
Ostfeld, A; Muzaffar, E; Lansey, KE

AF: Author Affiliation
Coll. of Engrg. and Mines, Dept. of Civ. Engrg. and Engrg. Mech., The Univ. of Arizona, Tucson, AZ 85721, USA
SO: Source
Journal of Irrigation and Drainage Engineering [J. Irrig. Drain. Eng.], vol. 125, no. 4, pp. 196-202, Aug 1999
IS: ISSN
0733-9437
AB: Abstract
A general solution scheme for determining ground-water levels for channel/group-water systems with recharge is developed and verified. The analytical solution uses the Laplace transform method to solve a linearized form of the Boussinesq equation. Unlike other solutions, this scheme allows for both boundaries and sources/sinks to vary as a function of time and space. To verify the analytical scheme, three one-dimensional case studies of flow between two line sources in an unconfined aquifer were explored through a base run and a set of sensitivity analyses. These runs involved comparisons to MODFLOW and changes in the boundary conditions and dimensions. As noted, the flow equations were linearized about a point called the representative flow depth. A value of havg, defined as the average water depth between the initial and steady flow conditions, was used as the representative flow depth. Results of the proposed method matched very well with MODFLOW solutions for all times and locations using an optimal linearization point. In addition, using havg improved the solutions compared to those obtained previously.
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1999
PD: Publication Date
19990800
PT: Publication Type
Journal Article
DE: Descriptors
Groundwater Level; Mathematical Equations; Case Studies; Sensitivity Analysis; Boundary Conditions; Water Depth; Channels; Surface-groundwater Relations; Aquifers; Groundwater Movement
ID: Identifiers
MODFLOW
CL: Classification
SW 0810 General; SW 0840 Groundwater
UD: Update
199912
SF: Subfile
Water Resources Abstracts
AN: Accession Number
4583070

Record 31 of 145

TI: Title
A Wetland Simulation Module for the MODFLOW Ground Water Model
AU: Author

Restrepo, JI; Montoya, AM; Obeysekera, J
AF: Author Affiliation
Dep. Geogr. and Geol., Florida Atlantic Univ., P.O. Box 3091, Boca Raton, FL 33431-0991, USA; E-mail: restrepo@fau.edu
SO: Source
Ground Water, vol. 36, no. 5, pp. 764-770, Oct 1998
IS: ISSN
0017-467X
PB: Publisher
Ground Water Publishing Company
AB: Abstract
The alteration of wetland habitats by natural and anthropogenic processes is an issue of worldwide concern. Understanding the changes that occur in wetlands often requires knowledge of how surface water levels relate to adjacent aquifer systems. The ability to simulate surface water movement and its interaction with ground water and wetland slough channels is a desirable step in the design of many projects constructed in or near wetlands. Currently, most ground water flow models incorporate wetland systems as general head boundary nodes. The purpose of this research was to develop a computer package for the widely used MODFLOW code that would simulate three-dimensional wetland flow hydroperiods and wetland interactions with aquifers and slough channels. The ground water flow model was used to reproduce the surface water flow process through wetlands, and then to estimate new flow rates and values using a Manning-type equation. This package represents flow routing, export and import of water, and evapotranspiration from wetlands for different hydroperiods. A basic verification procedure for the numerical solution of the diffusion equation was applied, based on a test case that was solved using a two-dimensional surface water model. This example is a transient solution to the diffusion equation, in which the initial conditions were depicted by a sinusoidal water surface profile and a flat bottom.
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1998
PD: Publication Date
19981000
PT: Publication Type
Journal Article
DE: Descriptors
Wetlands; Surface-groundwater Relations; Water Level; Aquifers; Groundwater; Computer Models; Hydrology; Evapotranspiration
ID: Identifiers
MODFLOW
CL: Classification
SW 2040 Groundwater management; SW 0810 General
UD: Update
199904
SF: Subfile
Water Resources Abstracts
AN: Accession Number
4471261

Record 33 of 145

TI: Title
Integrated catchment modelling
AU: Author
Wardlaw, RB; Wyness, A; Rippon, P
AF: Author Affiliation
Univ. Edinburgh, Edinburgh, UK
CF: Conference
European Geophysical Society XVIII General Assembly, Wiesbaden (Germany), May 1993
ED: Editor
Newman, AT (ed)
SO: Source
ENVIRONMENTAL IMPACT OF WATER RESOURCES DEVELOPMENTS: RECOGNITION, EVALUATION AND CONTROL., 1994, pp. 311-330, Surveys in Geophysics [SURV. GEOPHYS.], vol. 15, no. 3
IS: ISSN
0169-3298
AB: Abstract
The recent drought in the UK has focused attention on the requirement for more effective groundwater management practices in order to reduce the interference of groundwater abstraction on river flows to acceptable levels. Quantification of the impacts and the assessment of alternative management strategies requires the use of mathematical models. An Integrated Catchment Management Model is described which permits the direct assessment of alternative groundwater management practices on river flows. The model utilises a modified version of the Stanford Watershed Model for groundwater recharge estimation and for the computation of the surface and interflow components of runoff. The river system is incorporated implicitly in an integrated finite difference groundwater model. Groundwater flow to or from the river system is computed as a function of river level, which in turn is related to stage discharge characteristics of discrete reaches of the river system. The model has now been applied to a number of important groundwater systems in southern and eastern England. The calibration and verification results achieved in application to the River Allen catchment are presented. The approach maximises the use of readily available hydrological and hydrogeological information, and gives the water resources planner a sound framework and support for decision making.
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1994
PT: Publication Type
Book Monograph; Conference
DE: Descriptors
mathematical models; catchment area; droughts; ground water; water resources; water management; hydrology; regional planning; river basin management; drought; catchment areas; regional analysis; groundwater management; decision making; runoff
ER: Environmental Regime

Freshwater
TR: ASFA Input Center Number
CS9602479
CL: Classification
Q5 01523 Conservation, wildlife management and recreation; Q2 02127 General papers on resources; SW 0810 General
SF: Subfile
ASFA 3: Aquatic Pollution & Environmental Quality; ASFA 2: Ocean Technology Policy & Non-Living Resources; Water Resources Abstracts
AN: Accession Number
3837971

Record 35 of 145

TI: Title
Effect of Ground-Water Recharge on Configuration of the Water Table Beneath Sand Dunes and on Seepage in Lakes in the Sandhills of Nebraska, U.S.A
AU: Author
Winter, TC
AF: Author Affiliation
Geological Survey Lakewood, CO
SO: Source
Journal of Hydrology JHYDA7 Vol. 86, No. 3/4, p 221-237, October 1, 1986. 9 fig, 14 ref.
AB: Abstract
The interaction of lakes and ground water has been the subject of increased research during the past decade. Prior to this time , concepts of groundwater movement relative to lakes were based on little onsite data, or on studies where groundwater instrumentation at a site was inadequate; either too few wells were used or they were not appropriately placed. Analysis of water-level fluctuations in about 30 observation wells and 5 lakes in the Crescent Lake National Wildlife Refuge in the sandhills of Nebraska indicates water-table configuration beneath sand dunes in this area varies considerably, depending on the configuration of the topography of the dunes. If the topography of an interlake dunal area is hummocky, groundwater recharge is focused at topographic lows causing formation of water-table mounds. These mounds prevent groundwater movement from topographically high lakes to adjacent lower lakes. If a dune ridge is sharp, the opportunity for focused recharge does not exist, resulting in water-table troughs between lakes. Lakes aligned in descending altitudes, parallel to the principal direction of regional groundwater movement, generally have seepage from higher lakes toward lower lakes. (Alexander-PTT)
PY: Publication Year
1986
DE: Descriptors
Groundwater recharge; Surface-groundwater relations; Water table fluctuations; Sand dunes; Seepage; Lakes; Nebraska; Observation wells; Topography; Groundwater movement; Altitude; Sandhills; Dunes
CL: Classification
SW 0840 Groundwater; SW 0850 Lakes
SF: Subfile

Water Resources Abstracts
AN: Accession Number
8703823

Record 36 of 145

TI: Title
Integrated hydrological modelling in South Florida Water Management District
AU: Author
Yan, Jason; Hopkins, Emily; Sorensen, Henrik Refstrup; Kjelds, Jesper Tonnisen
AF: Author Affiliation
South Florida Water Management District, West Palm Beach, FL, USA
CF: Conference
The 1998 International Water Resources Engineering Conference. Part 1 (of 2), Memphis, TN, USA, 08/03-07/98
SO: Source
INT WATER RES ENG CONF PROC, ASCE, RESTON, VA, (USA), 1998, vol. 1, pp. 532-537,
PB: Publisher
ASCE, RESTON, VA, (USA)
AB: Abstract
A physically based, integrated hydrological modelling system is used by the South Florida Water Management District (SFWMD) to address water management issues involving interactions between ground water and surface water flow regimes. The modelling system is based on the MIKE SHE and MIKE 11 systems developed by the Danish Hydraulic Institute (DHI). The MIKE SHE/MIKE 11 modelling system is being further developed and tailored to South Florida conditions, as part of the project 'Small Scale Surface Water - Ground Water Model' being conducted by SFWMD. This paper provides a brief description of the applied MIKE SHE and MIKE 11 modelling systems and of the enhancements being carried out as part of the SFWMD project. Preliminary results of the first MIKE SHE application at the SFWMD are presented.
LA: Language
English
PY: Publication Year
1998
PD: Publication Date
19980000
PT: Publication Type
Book Monograph; Conference
DE: Descriptors
Groundwater flow; Surface waters; Mathematical models
ID: Identifiers
Water management
CL: Classification
EE 444 Water Resources; EE 471 Marine Science and Oceanography; EE 444.2 Groundwater; EE 631.1 Fluid Flow (General); EE 444.1 Surface Water
UD: Update
199812
SF: Subfile
Environmental Engineering Abstracts
AN: Accession Number

0351606

Record 38 of 145

TI: Title
Integrated management of alluvial ground water
AU: Author
Leaf, Forrest; Leaf, Charles
AF: Author Affiliation
Central Colorado Water Conservancy District, Greeley, CO, USA
CF: Conference
The 2nd International Symposium on Artificial Recharge of Ground Water, Orlando, FL, USA, 07/17-22/94
SO: Source
INT SYMP ARTIF RECHARGE GROUND WATER PROC, ASCE, NEW YORK, NY, (USA), 1995, pp. 492-501,
PB: Publisher
ASCE, NEW YORK, NY, (USA)
AB: Abstract
Alluvial ground water recharge is an integral part of the overall management of water resources in the South Platte Basin below Denver. In 1979, the Ground Water Management Subdistrict of the Central Colorado Water Conservancy District (Central) initiated alluvial recharge. Currently, Central operates 12 decreed artificial recharge facilities at five sites and has recharged a total of 62,725,000 m into the ground water alluvium. Central has established ground water monitoring wells on three of its larger recharge spreader basins to determine the impact of raw water recharge on ground water resource. Ground water nitrate-nitrogen (NO sub(3)-N) concentrations before recharge averaged 10.93 mg/l from three monitoring wells. Ground water NO sub(3)-N concentrations after recharge averaged 5.55 mg/l.
LA: Language
English
PY: Publication Year
1995
PT: Publication Type
Book Monograph; Conference
DE: Descriptors
Groundwater; Management; Groundwater resources; Rivers; Well pumps
ID: Identifiers
Integrated management; Alluvial groundwater; Artificial recharging underground waters; River basins; Well pumping
CL: Classification
EE 444.2 Groundwater; EE 912.2 Management; EE 444.1 Surface Water; EE 618.2 Pumps
SF: Subfile
Environmental Engineering Abstracts
AN: Accession Number
0180904

Record 40 of 145

TI: Title
Modeling the interrelationship of groundwater and surface water.
AU: Author
Winter, TC

AF: Author Affiliation
U.S. Geol. Surv., Denver Fed. Cent., Lakewood, CO, USA
ED: Editor
Schnoor, JL (ed)
SO: Source
MODELING OF TOTAL ACID PRECIPITATION IMPACTS., 1984, pp. 89-119, ACID PRECIP. SER., vol. 9
IB: ISBN
0-250-40574-1
AB: Abstract
Models that simulate the interaction between groundwater and surface water are important for the evaluation of subsurface movement of chemicals to and from surface water bodies. Before the availability of digital computers, most problems involving interrelated groundwater and surface water systems were solved analytically, which required the use of many simplifying assumptions with regard to aquifer geometry and internal complexity. With the development of numerical simulation, more complex problems were investigated resulting in increased understanding of actual situations.
LA: Language
English
PY: Publication Year
1984
PT: Publication Type
Book Monograph
DE: Descriptors
acid rain; ground water; surface water; water pollution; mathematical models; groundwater; acid precipitation
ER: Environmental Regime
Marine; Brackish; Freshwater
CL: Classification
Q1 01503 Characteristics, behavior and fate; Q2 02445 Characteristics, behavior and fate; P 0000 AIR POLLUTION; P 2000 FRESHWATER POLLUTION; D 04800 Pollution studies - general
SF: Subfile
ASFA 1: Biological Sciences & Living Resources; ASFA 2: Ocean Technology Policy & Non-Living Resources; Pollution Abstracts; Ecology Abstracts
AN: Accession Number
0758021

Record 47 of 145

TI: Title
Application of chemical mass balances (CMBs) to ground water and river interaction
AU: Author
Ahmad, Moid U; Koo, Ja-Kong; Kim, Yong-Woo
AF: Author Affiliation
Ohio Univ, ngineering & Toxic and Hazardous Substance Control, OH, USA
SO: Source
Journal of Environmental Science and Health, Part A: Environmental Science and Engineering & Toxic and Hazardous Substance Control [J ENVIR SCI HEALTH PART A], vol. 30, no. 3, pp. 567-582, 1995
IS: ISSN

1077-1204
PB: Publisher
MARCEL DEKKER INC, NEW YORK, NY, (USA)
AB: Abstract
This paper deals with interaction between ground water and an adjacent river. The interaction is described quantitatively by chemical mass balances (CMBs) which is the most widely used receptor model. Ground water and river upstream and downstream samples are tested for seventeen parameters to determine the ground water underflow rates to the river by using the CMBs. Also electrochemical compositions of major ions for each samples are analyzed to provide the characteristics of each water. Through the analyses for overall compositions between ground and river waters, the impact of ground water underflow to the river quality is evaluated.
LA: Language
English
PY: Publication Year
1995
PT: Publication Type
Journal Article
DE: Descriptors
Rivers; Mathematical models; Ions; Groundwater flow; Composition; Water quality
ID: Identifiers
Chemical mass balances; Underflow; Groundwater interaction; Hydrochemical
CL: Classification
EE 444.2 Groundwater; EE 444.1 Surface Water; EE 921.6 Numerical Methods; EE 931.3 Atomic and Molecular Physics; EE 445.2 Water Analysis
SF: Subfile
Environmental Engineering Abstracts
AN: Accession Number
0168307

Record 48 of 145

TI: Title
Interaction of ground water and surface water studied by loosely coupled models
AU: Author
Haagsma, Ijsbrand G; Johanns, Remco D
AF: Author Affiliation
Delft Univ of Technology, Delft, Neth
CF: Conference
Water Down Under 1994 Conference. Part 2-A (of 3), Adelaide, Aust, 11/21-25/94
SO: Source
NATL CONF PUBL INST ENG AUST, IE AUST, CROWS NEST, NSW, (AUST), 1994, vol. 2(A), no. 94/14, pp. 93-98,
IS: ISSN
0313-6922
PB: Publisher
IE AUST, CROWS NEST, NSW, (AUST)
AB: Abstract
This paper describes a way to study the interaction between

unsteady ground water and surface water flow. Current approaches describe the interaction at the interface in a quasi-steady way, where first the surface water movement is calculated and then the ground water flow using the results from the surface water model. A tightly coupled model, which would mean one source code for the calculation of both the surface water part and the ground water part is not desirable. This tightly coupled model would be very large and highly complex, hence difficult to maintain and not very flexible. Therefore integration of models is proposed by running existing models simultaneously, i.e. a ground water model and a surface water model, with continuous communication. Boundary conditions are exchanged by a proposed communication interface. Time and spatial scales of the hydrological processes are important issues when models are integrated. The study of ground water and surface water interaction is part of an approach to develop a decision support system for water management. The development of this decision support system will be discussed in this context.

LA: Language
English

PY: Publication Year
1994

PT: Publication Type
Book Monograph; Conference

DE: Descriptors
Surface waters; Groundwater; Groundwater flow; Mathematical models; Unsteady flow; Interfaces (materials); Integration; Boundary conditions; Hydrology; Decision support systems; Water levels; Water quality

ID: Identifiers
Surface water movement; Surface water flow; Polder; Groundwater levels; Water quantity

CL: Classification
EE 631.1 Fluid Flow (General); EE 444.1 Surface Water; EE 444.2 Groundwater; EE 921.6 Numerical Methods; EE 912.2 Management; EE 445.2 Water Analysis

SF: Subfile
Environmental Engineering Abstracts

AN: Accession Number
0158153

Record 51 of 145

TI: Title
Interactions between surface water and ground water in a central-Florida watershed

AF: Author Affiliation
Sch. Civ. Eng. and Environ. Sci., Univ. Oklahoma, Norman, OK 73019, USA

CF: Conference
15. Annual International Symposium of the North American Lake Management Society, Toronto, ON (Canada), 6-11 Nov 1995

ED: Editor
Gremillion, PT; Bachmann, RW; Jones, JR; Peters, RH; Soballe, DM (eds)

SO: Source

Lake and Reservoir Management [LAKE RESERV. MANAGE.], vol. 11, no. 2, pp. 142-143, 1995
IS: ISSN
0743-8141
NT: Notes
Summary only.
AB: Abstract
It is commonly believed that in most fiver systems, flow is composed primarily of surficial runoff from a recent storm event, or new water. Traditional hydrograph separation techniques, based on analysis of hydrograph shapes, confirm that new water is usually the major contributor of flow in rivers. This assumption was tested in a central-Florida watershed by analyzing a naturally-occurring conservative tracer found in all water, the oxygen-18 isotope. Results from an intensively-monitored storm event indicated that new water could account for only about 25 percent of the total storm flow. The surficial aquifer was reasoned to contribute the remaining flow. A significant implication of these findings is that receiving water quality may be tightly coupled with groundwater quality and that strategies for estimating and managing pollutant loads in rivers should recognize the potential influence of groundwater contributions.
LA: Language
English
PY: Publication Year
1995
PT: Publication Type
Journal Article; Conference; Summary
DE: Descriptors
USA, Florida, Central; surface-groundwater relations; oxygen isotopes; isotopic tracers; streamflow; water quality; groundwater pollution; watersheds; stream pollution; hydrology; rivers; ground water; pollution control; radioactive tracers; USA, Florida; pollution monitoring; freshwater pollution; tracer techniques
ER: Environmental Regime
Freshwater
TR: ASFA Input Center Number
CS9622795
CL: Classification
SW 0810 General; SW 3020 Sources and fate of pollution; Q2 02171 Dynamics of lakes and rivers; Q5 01505 Prevention and control; P 2000 FRESHWATER POLLUTION
SF: Subfile
Water Resources Abstracts; ASFA 2: Ocean Technology Policy & Non-Living Resources; ASFA 3: Aquatic Pollution & Environmental Quality; Pollution Abstracts
AN: Accession Number
3966902

Record 52 of 145

UFLIB Call: GB 1197.7.N38 1988
TI: Title
Spatially Distributed Modelling: Conceptual Approach, Coupling Surface Water and Groundwater
AU: Author
Ledoux, E; Girard, G; de Marsily, G

AF: Author Affiliation
Ecole Nationale Superieure des Mines de Paris Fontainebleau (France). Centre d'Information Geologique
SO: Source
Unsaturated Flow in Hydrologic Modeling: Theory and Practice. Kluwer Academic Publishers Boston. 1989. p 435-454, 13 fig, 2 tab, 35 ref.
AB: Abstract
The joint modeling of surface and groundwater flows is examined by presenting and describing the MC (coupled model) model. The purpose of this deterministic physically-based model is to simulated the behavior of available water resources for one or several watershed. The model integrates surface flow, streamflow , flow in the unsaturated zone, groundwater flow and the interactions between rivers and water tables. Its formulation and its structure, especially its nested square meshes of variable sizes, give a great deal of flexibility to the model; this facilitates adaptation to variable modeling scales and to a wide range of geological, geographical and climatological conditions. An application of the MC model on the Caramy watershed in France is illustrated. (See also W90-01590) (Author 's abstract)
PY: Publication Year
1989
DE: Descriptors
Soil water; Model studies; Surface-groundwater relations; Groundwater movement; Streamflow; Surface flow; Aeration zone; Unsaturated flow; Water table; Aquifers; Soil water; Hydrographs; Coupled model; Caramy watershed; France
CL: Classification
SW 5080 Evaluation, processing and publication; SW 0840 Groundwater; SW 0845 Water in soils
SF: Subfile
Water Resources Abstracts
AN: Accession Number
9001606

Record 55 of 145

TI: Title
Groundwater-surface water interactions in headwater forested wetlands of the Canadian Shield
AU: Author
Devito, KJ; Hill, AR; Roulet, N
AF: Author Affiliation
Dep. Geogr., Univ. Toronto in Mississauga, Erindale Coll., 3359 Mississauga Rd., North, Mississauga, Ont. L5L 1C6, Canada
SO: Source
Journal of Hydrology (Amsterdam) [J. HYDROL. (AMST.)], vol. 181, no. 1-4, pp. 127-147, 1996
IS: ISSN
0022-1694
AB: Abstract
Groundwater and surface water interaction in two conifer swamps located in headwater catchments with contrasting till depth, typical of the southern Canadian Shield, were studied from June 1990 to August 1992. Both swamps had little influence on the regulation or attenuation of seasonal runoff response in the

catchment. The two valley bottom swamps were connected to local aquifers but the upland-wetland connection was continuous in the catchment with deeper till and ephemeral in the catchment with thin till-rock ridges. Groundwater movement through the wetlands was restricted mainly to the surface peat layer in both wetlands, because a large portion of inputs from shallow soil layers and stream inflows enter near the peat surface. However, differences in upland-wetland connections resulted in contrasting hydrologic regimes in the two swamps. During seasons with larger inputs, both swamps were hydrologically connected to uplands and had a similar hydrology characterized by a high water table, rapid storm response, and predominance of saturated overland flow. In summer, upland inputs were absent in the catchment with thin till-rock ridges, resulting in cessation of baseflow and a lower water table that varied in response to variations in rainfall. Continuous upland inputs throughout the summer in the catchment with deeper tills (1-3 m) sustained baseflow and kept the water table near the peat surface. This study demonstrates the control of morphology and shallow subsurface geology on the hydrology of valley bottom swamps influenced by local aquifers.

LA: Language
English
SL: Summary Language
English
PY: Publication Year
1996
PT: Publication Type
Journal Article
DE: Descriptors
surface-groundwater relations; forest hydrology; swamps; headwaters; runoff; catchment areas; wetlands; hydrological regime; hydrology; catchment area; vegetation cover; stormwater runoff; ground water
ER: Environmental Regime
Freshwater
TR: ASFA Input Center Number
CS9617985
CL: Classification
SW 0810 General; Q2 02171 Dynamics of lakes and rivers
SF: Subfile
Water Resources Abstracts; ASFA 2: Ocean Technology Policy & Non-Living Resources
AN: Accession Number
3937975

Record 56 of 145

TI: Title
Quantifying groundwater discharge to a small perennial stream in southern Ontario, Canada
AU: Author
Cey, EE; Rudolph, DL; Parkin, GW; Aravena, R
AF: Author Affiliation
Department of Earth Science, University of Waterloo, Waterloo, Ontario, Canada; E-mail: drudolph@sciborg.uwaterloo.ca
SO: Source
Journal of Hydrology (Amsterdam) [J. Hydrol. (Amst.)], vol. 210,

no. 1-4, pp. 21-37, Sep 1998
IS: ISSN
0022-1694
AB: Abstract
A study of the interaction between groundwater and surface water was undertaken within a small agricultural watershed in southern Ontario, Canada. Groundwater contributions to streamflow were measured along a section of stream during baseflow conditions and during rainfall events. Four techniques were used to estimate the contribution of groundwater to the stream along a 450 m reach (three during baseflow and one during stormflow conditions). Under baseflow conditions, streamflow measurements using the velocity-area technique indicated that the net groundwater flux to the stream during the summer months was similar to 10 ml s super(-1) m super(-1). Hydrometric measurements (i.e. hydraulic gradient and hydraulic conductivity) taken using mini-piezometers installed in the sediments beneath the stream resulted in net groundwater flux estimates that were four to five times lower. Seepage meters failed to provide any measurements of water flux into or out of the stream. Therefore, based on these results, the velocity-area technique gives the best estimate of groundwater discharge. Hydrograph separations were conducted using super(18)O/ super(16)O isotopic ratios and electrical conductivity on two large rainfall events with different antecedent moisture conditions in the catchment. Both events showed that pre-event water (generally considered groundwater) dominated streamflow and tile drain flow with 64%-80% of the total discharge contributed by pre-event water. High water table conditions within the catchment resulted in greater stream discharge and a greater contribution of event water in the streamflow than that observed under low water table conditions for similar intensity storm events. The results also showed that differences in riparian zone width, vegetation and surface saturation conditions between the upper and lower catchment can influence the relative magnitude of streamflow response from the two catchment areas.
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1998
PD: Publication Date
19980900
PT: Publication Type
Journal Article
DE: Descriptors
Canada, Ontario, southern; Surface-groundwater Relations; Quantitative Analysis; Hydrograph Analysis; Saturation; Groundwater Discharge; Catchment Areas; Perennial Streams; Agricultural Watersheds; Water Table; Base Flow; Stream Discharge; Ground water; Surface water; Stream flow; Catchment area; Watersheds; Seepages; Storms; Canada, Ontario
ID: Identifiers
Baseflow; Hydrographs
ER: Environmental Regime
Freshwater
TR: ASFA Input Center Number

CS9920084
CL: Classification
SW 0810 General; Q2 02171 Dynamics of lakes and rivers
UD: Update
199910
SF: Subfile
Water Resources Abstracts; ASFA 2: Ocean Technology Policy & Non-Living Resources
AN: Accession Number
4424998

Record 57 of 145

TI: Title
Numerical Solution of the Problem of Interaction of Surface and Subsurface Waters
AU: Author
Badov, VV; Kiselev, AA
SO: Source
Water Resources Vol. 10, No. 1, p 28-41, January-February, 1983. 6 Fig, 1 Tab, 14 Ref. Translated from Vodnye Resursy, No. 1, p 66-80, January-February, 1983.
AB: Abstract
The established ideas about the unity and continuity of the movements of water in the atmosphere, on the ground surface, in rocks, and in plant tissues are the premises for creating a generalized mathematical model of the interaction of surface and subsurface waters. A solution is proposed to the mixed internal boundary-value problem for a quasilinear partial differential equation describing the combined unsteady flow of groundwaters and moisture of the zone of aeration in a two-dimensional piecewise-homogeneous profile-plant region on the contours of which can be assigned boundary conditions approximating regime-forming factors. The advantages of the proposed method of studying the interaction of surface and subsurface water compared to the water balance method become obvious when one takes into account that all components of the water balance are expressed in terms of discharge and each of them requires determination by an independent method. (Baker-IVI)
PY: Publication Year
1983
DE: Descriptors
Surface waters; Groundwater; Surface-groundwater relations; Mathematical models; Model studies; Soil-water-plant relationships; Groundwater recharge; Seepage; Soil water; Flow; Hydrologic budget
CL: Classification
SW 0810 General
SF: Subfile
Water Resources Abstracts
AN: Accession Number
8402344

Record 60 of 145

TI: Title
Dynamics of the interface between streams and groundwater systems

in lowland areas, with reference to stream net evolution
AU: Author
De Vries, JJ
AF: Author Affiliation
Inst. Earth Sci., Vrije Univ., De Boelelaan 1085, 1081 HV Amsterdam, Netherlands
SO: Source
Journal of Hydrology (Amsterdam) [J. HYDROL. (AMST.)], vol. 155, no. 1-2, pp. 39-56, 1994
IS: ISSN
0022-1694
AB: Abstract
Observations reveal a close relationship between groundwater depth and stream net characteristics in the permeable lowlands of the sandy Pleistocene area of the Netherlands. This applies for average conditions as well as for the seasonal expansion and contraction of the network of streams that participate in the drainage process. It is plausible that this observed relation is caused by the close connection between groundwater and surface water in an area where almost all precipitation surplus is discharged as groundwater. Under such conditions a stream system can be considered the outcrop of a groundwater flow system. The hypothesis is that the stream network, as the interface between both systems, must have adapted in response to the discharge capacity that is required to release the precipitation surplus through the continuum of ground waters and surface waters. A theoretical model of coupled groundwater and surface water drainage systems is proposed that gives the stream net density and channel dimensions as functions of the geological and climatic conditions. The theoretically derived relationships of increasing stream density and decreasing channel size with reducing depth to groundwater and reducing topographic slope reflect the observed situation. The model further allows for assessment of the response of a drainage network to a changing environment.
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1994
PT: Publication Type
Journal Article
DE: Descriptors
stream flow rate; ground water; Netherlands; hydrodynamics; river discharge; drainage patterns; streams; groundwater; surface-groundwater relations; precipitation; groundwater recharge
ER: Environmental Regime
Freshwater
TR: ASFA Input Center Number
CS9407741
CL: Classification
Q2 02171 Dynamics of lakes and rivers; SW 0810 General; SW 0840 Groundwater
SF: Subfile
ASFA 2: Ocean Technology Policy & Non-Living Resources; Water Resources Abstracts
AN: Accession Number

3553758

Record 63 of 145

TI: Title
Alluvial characteristics, groundwater--surface water exchange and hydrological retention in headwater streams

AU: Author
Morrice, JA; Valett, HM; Dahm, CN; Campana, ME
AF: Author Affiliation
Department of Biology, University of New Mexico, Albuquerque, NM 87131, USA

SO: Source
Hydrological Processes [HYDROL. PROCESSES], vol. 11, no. 3, pp. 253-267, Mar 1997
IS: ISSN
0885-6087
PB: Publisher
John Wiley & Sons

AB: Abstract
Conservative solute injections were conducted in three first-order montane streams of different geological composition to assess the influence of parent lithology and alluvial characteristics on the hydrological retention of nutrients. Three study sites were established: (1) Aspen Creek, in a sandstone--siltstone catchment with a fine-grained alluvium of low hydraulic conductivity (1.3 x 10 super(-4) cm/s), (2) Rio Calaveras, which flows through volcanic tuff with alluvium of intermediate grain size and hydraulic conductivity (1.2 x 10 super(-3) cm/s), and (3) Gallina Creek, located in a granite/gneiss catchment of coarse, poorly sorted alluvium with high hydraulic conductivity (4.1 x 10 super(-3) cm/s). All sites were instrumented with networks of shallow groundwater wells to monitor interstitial solute transport. The rate and extent of groundwater--surface water exchange, determined by the solute response in wells, increased with increasing hydraulic conductivity. The direction of surface water--groundwater interaction within a stream was related to local variation in vertical and horizontal hydraulic gradients. Experimental tracer responses in the surface stream were simulated with a one-dimensional solute transport model with inflow and storage components (OTIS). Model-derived measures of hydrological retention showed a corresponding increase with increasing hydraulic conductivity. To assess the temporal variability of hydrological retention, solute injection experiments were conducted in Gallina Creek under four seasonal flow regimes during which surface discharge ranged from baseflow (0.75 1/s in October) to high (75 1 /s during spring snowmelt). Model-derived hydrological retention decreased with increasing discharge. The results of our intersite comparison suggest that hydrological retention is strongly influenced by the geologic setting and alluvial characteristics of the stream catchment. Temporal variation in hydrological retention at Gallina Creek is related to seasonal changes in discharge, highlighting the need for temporal resolution in studies of the dynamics of surface water--groundwater interactions in stream ecosystems.

LA: Language
English

SL: Summary Language
English
PY: Publication Year
1997
PT: Publication Type
Journal Article
DE: Descriptors
surface-groundwater relations; geology; Alluvial Deposits; tracers; permeability coefficient; catchment areas; solute transport; ground water; rivers; stream flow
TR: ASFA Input Center Number
CS9721709
CL: Classification
SW 0810 General; SW 0840 Groundwater; Q2 02171 Dynamics of lakes and rivers
SF: Subfile
Water Resources Abstracts; ASFA 2: Ocean Technology Policy & Non-Living Resources
AN: Accession Number
4202575

Record 64 of 145

TI: Title
Chemical Interactions Between Surface Water and Ground Water in the Zekiah Swamp Run Stream Valley
AU: Author
Price, RM; Keating, RW
SO: Source
IN: Ground Water Issues and Solutions in the Potomac River Basin/Chesapeake Bay Region. National Water Well Association, Dublin, Ohio. 1989. p 31-45. 5 fig, 2 tab. 7 ref.
AB: Abstract
Zekiah Swamp Run, in Charles County, Maryland, drains an area of approximately 110 square miles into the Wicomico River, a tributary of the Potomac River. An electric utility fly ash fill is located towards the southern end of the north-south trending Zekiah Swamp Run Valley. Dissolved major ion constituents, derived from the fly ash fill, were used as tracers to investigate the chemical interactions between surface water and groundwater within the valley. Groundwater occurs under unconfined conditions in the Pleistocene Age sand and gravel aquifer. This aquifer is five to twenty feet thick and underlain by the confining silts of the Calvert Formation. Intermittent streams in the watershed are tributaries of Zekiah Swamp Run, and in places are hydraulically connected to the sand and gravel aquifer. Nine observation wells in the sand and gravel aquifer provided hydrologic and groundwater quality data. Groundwater samples and twelve surface water samples were collected and analyzed for major cations and anions during three consecutive bimonthly sampling events. Stiff diagrams were constructed using major ion constituents to determine the chemical interaction between groundwater and surface water. These diagrams indicate that groundwater discharges to the upper reaches of the intermittent streams, thereby affecting the chemical character of the streams there. Further downgradient the reverse seems to be true; the intermittent streams recharge the aquifer system prior to discharge, affecting the water chemistry of the groundwater.

(See also W91-09628) (Author's abstract)
PY: Publication Year
1989
DE: Descriptors
Base flow; Dissolved solids; Groundwater; Influent streams; Surface-groundwater relations; Water chemistry; Chemical analysis; Fly ash; Maryland; Stiff diagrams; Stream discharge; Tracers
CL: Classification
SW 0840 Groundwater; SW 0835 Streamflow and runoff; SW 0880 Chemical processes
SF: Subfile
Water Resources Abstracts
AN: Accession Number
9109631

Record 70 of 145

TI: Title
Impacts of Surface Drainage on Ground Water Hydraulics.
AU: Author
Wang, FC; Overman, AR
AF: Author Affiliation
Dept. Marine Sci., Ctr. Wetland Resources, LA St. Univ., Baton Rouge, LA 70803
SO: Source
WATER RESOURCES BULL., vol. 17, no. 6, pp. 971-977, 1981
AB: Abstract
The current dredge and fill practices in locating canals along the periphery of wetlands in south Florida are transforming natural basins that originally had primarily slower subsurface drainage to ones that discharge larger quantities of water faster, via a surface drainage system. The objective of this paper is to develop an analytical technique and a numerical model in quantifying the difference of surface and subsurface runoff before and after the construction of drainage canals, and for delineating the effects of drains on channel level and regional water tables in adjacent areas in south Florida. The surface runoff model is formulated on the climatic water balance technique, and the ground water model is treated as a one dimensional transient phenomenon that forms a nonlinear flow problem. Analytical solutions are derived through problem linearization. These two models are coupled to estimate the impact of drainage canals on the adjacent water table drawdown.
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1981
PT: Publication Type
Journal Article
DE: Descriptors
drainage; groundwater; hydraulics; runoff; water table; environmental impact; irrigation; ecology; mathematical modeling; flow of liquids; irrigation and damage
ID: Identifiers
evapotranspiration; fluid mechanics; nonlinear equations

CL: Classification
I 3550 MECHANICS OF LIQUIDS; H SE3.21 WATER POLLUTION/WATER QUALITY; P 2000 FRESHWATER POLLUTION; C CA15.2 GEOLOGY; C CS2.1.8 BIOLOGICAL SCIENCE AND ENGINEERING
SF: Subfile
Mechanical Engineering Abstracts (ISMEC); Health & Safety Science Abstracts; Pollution Abstracts; Computer and Information Systems Abstracts
AN: Accession Number
0198459

Record 72 of 145

TI: Title
Coupled Surface Water and Groundwater Catchment Model
AU: Author
Miles, JC; Rushton, KR
AF: Author Affiliation
University Coll. Cardiff (Wales). Dept. of Civil and Structural Engineering
SO: Source
Journal of Hydrology Vol. 62, No. 1-4, p 159-177, April, 1983. 10 Fig, 1 Tab, 19 Ref.
AB: Abstract
For river catchments in which there is significant interconnection between aquifers and the river, a thorough understanding of the way in which water is exchanged between the river and the underlying strata is important for resources planning. The formation of a model to represent surface and subsurface flows of water for a catchment in central England is described. A finite-difference model is used to represent groundwater flows in an aquifer with surface water flows being represented by flow balance techniques. Three hydrologically significant land types have been identified in the catchment: aquifer covered by permeable deposits; low-permeability strata covered by permeable deposits; and areas covered by impermeable drift. The model contains three components which correspond to these. The mode has been designed to be used as a tool for determining the long-term environmental effect of abstraction from the catchment. River flows are calculated for over 120 locations within the catchment. The results show that it is possible to formulate a comprehensive model, of a complete catchment, based upon measurable, physical parameters with the inflow of water being calculated solely from rainfall and evapotranspiration estimates. (Moore-IVI)
PY: Publication Year
1983
DE: Descriptors
River basins; Catchment areas; Groundwater movement; Surface flow; Hydrologic models; Mathematical models; Aquifers; Rainfall; Evapotranspiration; Geohydrology
CL: Classification
SW 0810 General
SF: Subfile
Water Resources Abstracts
AN: Accession Number
8401398

Record 77 of 145

TI: Title
A framework for quantitative analysis of surface water-groundwater interaction: Flow geometry in a vertical section
AU: Author
Nield, SP; Townley, LR; Barr, AD
AF: Author Affiliation
Nield Consult., Nedlands, W.A., Australia
SO: Source
Water Resources Research [WATER RESOUR. RES.], vol. 30, no. 8, pp. 2461-2476, 1994
IS: ISSN
0043-1397
LA: Language
English
SL: Summary Language
English
PY: Publication Year
1994
PT: Publication Type
Journal Article
DE: Descriptors
model studies; groundwater movement; surface-groundwater relations; aquifer characteristics; anisotropy; permeability coefficient; flow; ground water; fluid flow; hydrodynamics; hydrology; freshwater lakes; wetlands; shallow water; mathematical models
ER: Environmental Regime
Freshwater
TR: ASFA Input Center Number
CS9511805
CL: Classification
SW 0810 General; SW 0840 Groundwater; Q2 02171 Dynamics of lakes and rivers
SF: Subfile
Water Resources Abstracts; ASFA 2: Ocean Technology Policy & Non-Living Resources
AN: Accession Number
3729308

Record 82 of 145

TI: Title
Integrated numerical modeling for basin-wide water management: The case of the Rattlesnake Creek basin in south-central Kansas
AU: Author
Sophocleous, MA; Koelliker, JK; Govindaraju, RS; Birdie, T; Ramireddygari, SR; Perkins, SP
AF: Author Affiliation
Univ of Kansas, Lawrence, KS, USA
SO: Source
Journal of Hydrology [J Hydrol], vol. 214, no. 1-4, pp. 179-196, Jan 1999
IS: ISSN
0022-1694
PB: Publisher

ELSEVIER SCIENCE B.V., AMSTERDAM, (NETHERLANDS)

AB: Abstract
A comprehensive computer model that is capable of simulating the surface water, groundwater, and stream-aquifer interactions on a continuous basis for the Rattlesnake Creek basin in south-central Kansas, is proposed. Known as SWATMOD, the model, is a combination of the agriculturally-based watershed model SWAT and the groundwater model MODFLOW, and will be used as a tool for evaluating long-term water management strategies. A graphical user interface and a decision support system were developed to evaluate scenarios involving manipulation of water rights and agricultural land uses on stream-aquifer systems response.

LA: Language
English

PY: Publication Year
1999

PD: Publication Date
19990100

PT: Publication Type
Journal Article

DE: Descriptors
Aquifers; Watersheds; Groundwater resources; Surface water resources; Decision support systems; Graphical user interfaces; Computer simulation; Land use

ID: Identifiers
Basin water management; Stream-aquifer interactions; Software package SWATMOD

CL: Classification
EE 444 Water Resources; EE 444.2 Groundwater; EE 444.1 Surface Water; EE 723 Computer Software, Data Handling and Applications; EE 912.2 Management; EE 722.2 Computer Peripheral Equipment

UD: Update
199906

SF: Subfile
Environmental Engineering Abstracts

AN: Accession Number
0388452

Record 84 of 145

TI: Title
(Feasibility of seepage measurement between ground water and surface waters.).

OT: Original Title
Moeglichkeiten zur Messung des Wasseraustausches zwischen Grund- und Oberflaechengewaessern in durchlaessigen Lockergesteinen

AU: Author
Driescher, E

AF: Author Affiliation
Akad. Wiss. DDR, Inst. Geogr. und Geooekol., Ber. Hydrol., Mueggelseedamm 260, Berlin, DDR-1162, GDR

SO: Source
Acta Hydrophysica [ACTA HYDROPHYS.], vol. 32, no. 2-3, pp. 111-125, 1988

IS: ISSN
0065-1338

AB: Abstract

The interaction between lakes and groundwater, especially the direct measurement of this process, is a topic which had received growing but relatively little attention by scientists. This paper summarizes the principles of seepage measurements. Limits of application as well as advantages of in-situ measurements are discussed. They will be of increasing interest in concern of groundwater protection and lake contamination.

LA: Language
German

SL: Summary Language
German; English; Russian

PY: Publication Year
1988

PT: Publication Type
Journal Article

DE: Descriptors
hydrologic cycle; lakes; measurement; groundwater pollution; hydrology; monitoring measurements; environmental monitoring; contaminants

ID: Identifiers
ground water

ER: Environmental Regime
Freshwater

CL: Classification
Q2 02171 Dynamics of lakes and rivers; Q5 01502 Methods and instruments; P 2000 FRESHWATER POLLUTION

SF: Subfile
ASFA 2: Ocean Technology Policy & Non-Living Resources; ASFA 3: Aquatic Pollution & Environmental Quality; Pollution Abstracts

AN: Accession Number
2268960

Record 91 of 145

TI: Title
Some Current Problems in Investigations of the Interaction of Subsurface and Surface Waters of the USSR

AU: Author
Kulikov, GV; Kurennoi, VV

AF: Author Affiliation
Vsesoyuznyi Nauchno-Issledovatel'skii Inst. Gidrogeologii i Inzhenerdoi Geologii Moscow (USSR)

SO: Source
Water Resources (English Translation) Vol 9, No 2, p 144-148, March-April, 1982. 1 Tab. Translated from Vodnye Resursy, No 2, p 46-52, March-April, 1982.

AB: Abstract
Studies are being conducted in river valleys to characterize the interaction of subsurface and surface waters under river valleys. The principals of schematization of hydrogeological conditions have been developed. Typical drainage schemes have been compiled. Approximate parameters and the concept of zone of deformation of the subsurface flow have been introduced. Attempts have been made to classify this interaction of subsurface and surface waters. The proposed classification is based on isolating the leading genetic factors of the interaction of the waters and performing a general evaluation of the extent and conditions of manifestation of these

factors and the character of the balance direction of the processes. It should be noted that the natural conditions of the territory of the USSR include each of the distinguished types and all factors of the interaction of natural waters. Although tidal, hydraulic, and technogenic factors are manifested under more specific conditions, the targets of the effects of these factors have been inadequately studied and classified. The difference between the tidal and hydraulic factors of interaction follows from the uniqueness of the nature of the energy involved, cosmic and hydrographic, and the directions of the processes, i.e., rhythmic, inflow-outflow, and outflow. The main tasks in studying the interaction of subsurface and surface waters should be regionalization of hydrogeological and hydrological conditions of the country by types of interaction and in investigation of its regularities, with consideration of landscape and climatic zonation. It is necessary to develop a spacetime prediction and in general a theory of monitoring the interrelation of subsurface waters and their control. (Baker-FRC)

PY: Publication Year
1982

DE: Descriptors
Subsurface water; USSR; Surface-groundwater relations; Surface water; Water transfer; Water resources; Water supply; Groundwater; Water supply development; Water demand; Conjunctive use

CL: Classification
SW 4040 Water demand; SW 1020 Water yield improvement

SF: Subfile
Water Resources Abstracts

AN: Accession Number
8303734

Record 94 of 145

TI: Title
Hydrology and water quality near the South Well Field, southern Franklin County, Ohio, with emphasis on the simulation of ground-water flow and transport of Scioto River.

AU: Author
Childress, CJO; Sheets, RA; Bair, ES

CA: Corporate Author
Geological Surv., Columbus, OH (USA). Water Resources Div.

SO: Source
WATER RESOUR. INVEST. U.S. GEOL. SURV., 1991, 88 pp

NT: Notes
NTIS Order No.: PB92-155035/GAR.

NU: Other Numbers
USGS/WRI-91-4080

AB: Abstract
At present (1990), about 15 percent of the total water supply for the City of Columbus, Ohio, is provided by ground water withdrawn from the South Well Field in southern Franklin County. Much of the flow of Scioto River at the South Well Field originates from the Jackson Pike Wastewater Treatment Facility (WTF), one of two municipal wastewater-treatment plants operated by the City of Columbus. The Jackson Pike WTF discharges effluent into Scioto River about 6 mi upstream from the South Well Field. The U.S. Geological Survey (USGS), undertook a study to evaluate the

hydrologic consequences of changes in effluent discharge to Scioto River and to clarify the interaction of Scioto River and carbonate bedrock and glacial drift aquifers at the South Well Field. The report describes the hydrology and water quality of the South Well Field area by presenting the results of (1) surface-water-transport simulations of a conservative constituent during low flow of Scioto River from Frank Road to the South Well Field and (2) ground-water-flow simulations of the glacial drift and carbonate bedrock aquifers at the South Well Field. The simulations are examined along with surface-water and ground-water quality to describe the relation between the quantity and quality of flow in the Scioto River; the nature of the ground-water-flow system; and the quantity, quality, and sources of water pumped from the South Well Field. Data collection in the study area in August and September 1987 and 1988 included sampling for surface-water and ground-water quality and measurement of surface-water discharge, Scioto River travel-times, ground-water levels, and vertical riverbed hydraulic conductivity. (Prepared in cooperation with Columbus, OH.)

LA: Language
English

SL: Summary Language
English

PY: Publication Year
1991

PT: Publication Type
Report

DE: Descriptors
water quality; water resources; water conservation; hydrology; environmental monitoring; surface water; ground water; USA, Ohio, Franklin Cty., Scioto R.; groundwater

ER: Environmental Regime
Freshwater

CL: Classification
Q2 02127 General papers on resources; Q5 01503 Characteristics, behavior and fate; P 2000 FRESHWATER POLLUTION

SF: Subfile
ASFA 2: Ocean Technology Policy & Non-Living Resources; ASFA 3: Aquatic Pollution & Environmental Quality; Pollution Abstracts

AN: Accession Number
2996950

Record 101 of 145

TI: Title
A Study of Groundwater--Surface Water Interaction in the Winter River, Prince Edward Island Using Seepage Meters and Mini-Piezometers

AU: Author
Cruikshanks, FB; Francis, RM; Jardine, DE

AF: Author Affiliation
Water Planning and Management Branch, Inlands Waters/Lands, Conservation and Protection, Environment Canada, Dartmouth, Nova Scotia, Canada

SO: Source
IN: International Groundwater Symposium on Hydrogeology of Cold and Temperate Climates and Hydrogeology of Mineralized Zones.

Proceedings of the Symposium held May 1-5, 1988, Halifax, Nova Scotia, Canada. (1989). p 29-40, 8 fig, 8 tab, 13 ref.

AB: Abstract

There is a concern that the municipal groundwater withdrawals from the Brackley and Union well fields in the Winter River basin, Prince Edward Island, may be diverting base flow from the Winter River. Consequently, a field study, using seepage meters and mini-piezometers, was undertaken to measure zones of groundwater recharge and discharge through the bed of the Winter River from Brackley to Suffolk, a distance of nearly 17 km. Also examined was the groundwater-surface water interaction occurring under the experimental conditions of excessive pumping and non-pumping in the Brackley and Union well fields. Direct measurements of seepage flux were obtained from 29 sites in 8 study locations, and falling head tests were conducted at 52 sites in 9 study locations. Spatial differences in seepage flux ranged between zero and 0.00089 cu cm/sq m/sec. The rate of groundwater seepage flux appears to increase down the watershed as regional groundwater discharge augments shallow, local groundwater seepage. The streambed of the Winter River in the study area was a groundwater discharge zone under natural conditions, and a recharge zone near the Brackley and Union well fields, under the influence of pumping. Reduction in groundwater discharge due to heavy pumping varied between 49% and 83% depending on the location. The characteristics of the groundwater-surface water interaction identified in the Winter River Basin, suggests that increased pumping from well fields at Brackley and Union could reduce baseflow in that portion of the Winter River to unacceptable levels. (See also W91-08706) (Lantz-PTT)

PY: Publication Year

1989

DE: Descriptors

Piezometers; Prince Edward Island; Seepage; Surface-groundwater relations; Winter River; Canada; Flow discharge; Flow velocity; Groundwater mining; Groundwater recharge; Groundwater resources; Pumping

CL: Classification

SW 0840 Groundwater; SW 0835 Streamflow and runoff

SF: Subfile

Water Resources Abstracts

AN: Accession Number

9108710

Record 102 of 145

TI: Title

Simulating three-dimensional ground water response in a small mountainous watershed

AU: Author

Flerchinger, GN; Shang, Shuangling; Finnie, JI

AF: Author Affiliation

Northwest Watershed Res. Cent., USDA Agric. Res. Serv., 800 Park Blvd., Suite 105, Boise, ID 83712, USA

SO: Source

Water Resources Bulletin [WATER RESOUR. BULL.], vol. 32, no. 5, pp. 1081-1088, 1996

IS: ISSN

0043-1370

AB: Abstract

Snowmelt from deep mountainous snowpacks is seldom rapid enough to exceed infiltration rates; thus, the source of streamflow in many mountainous watersheds is snowmelt recharge through shallow ground water systems. The hydrologic response and interaction between surface and sub-surface flow processes in these watersheds, which is controlled by basin structure, the spatial distribution of snowmelt, and the hydrogeology of the subsurface, are not well understood. The purpose of this study was to test a three-dimensional ground water model using simulated snowmelt input to simulate ground water response to spatially distributed snowmelt on the Upper Sheep Creek Watershed located within the Reynolds Creek Experimental Watershed in Southwestern Idaho. The model was used to characterize the mountainous aquifer and to delineate the subsurface flow mechanisms. Difficulty in finding a reasonable combination of grid spacing and time stepping within the model was encountered due to convergence problems with the Picard solution to the non-linear variably saturated ground water flow equations. Simulation results indicated that flow may be either unconfined or confined depending on inflow rate and hydrogeologic conditions in the watershed. The flow mechanism had a much faster response time when confined flow occurred. Response to snowmelt from a snow drift approximately 90 m away took only a few hours when flow was confined. Simulated results showed good agreement with piezometer measurements both in magnitude and timing; however, convergence problems with the Picard solution limited applicability of the model.

LA: Language
English

SL: Summary Language
English

PY: Publication Year
1996

PT: Publication Type
Journal Article

DE: Descriptors
USA, Idaho, Upper Sheep Creek Watershed; simulation; watersheds; mountains; geohydrology; snowmelt; groundwater movement; surface-groundwater relations; spatial distribution; model testing; hydrologic models

CL: Classification
SW 0810 General

SF: Subfile
Water Resources Abstracts

AN: Accession Number
3968406

Record 106 of 145

TI: Title
The Interaction of Lakes with Variably Saturated Porous Media

AU: Author
Winter, TC

AF: Author Affiliation
Geological Survey Denver, CO

SO: Source

Water Resources Research Vol. 19, No. 5, p 1203-1218, October, 1983. 9 Fig, 38 Ref.

AB: Abstract
Numerical simulation of variably saturated porous media indicates that groundwater recharge is variable in time and space, depending on the thickness of the unsaturated zone through which infiltrating water must move. The resulting complex, transient groundwater flow systems have significant impact on contiguous surface water. In very permeable media, small, local, closed groundwater flow systems can develop and dissipate within a few weeks to several months after major recharge. These have a direct effect on contiguous surface water by alternately causing seepage to and seepage from the surface water. The transient nature of these flow systems indicates that reversals of the direction of groundwater flow may be common. In less permeable media the same complex flow systems may occur, but the time for development and dissipation is much greater. For example, it is conceivable that small, local flow systems may exist for many months or years as a result of major recharge. Therefore directions of flow in such systems are more stable, and the effect on contiguous surface water also is more stable. The findings of this study indicate that wells and groundwater quality sampling sites need to be carefully located to define accurately water table configuration, groundwater recharge, direction of seepage through the beds of surface water bodies, and complex geochemical processes related to changing directions of groundwater flow. (Author 's abstract)

PY: Publication Year
1983

DE: Descriptors
Groundwater movement; Lakes; Porous media; Saturation; Groundwater recharge; Seepage; Surface water; Infiltration; Simulation; Aeration zone

CL: Classification
SW 0840 Groundwater; SW 0850 Lakes

SF: Subfile
Water Resources Abstracts

AN: Accession Number
8402764

Record 107 of 145

TI: Title
Integrated hydrologic modeling with geographic information systems.

AU: Author
Ross, Mark A; Tara, Patrick D

AF: Author Affiliation
Univ of South Florida, Tampa, FL, USA

SO: Source
Journal of Water Resources Planning and Management [J WATER RESOUR PLANN MANAGE.], vol. 119, no. 2, pp. 129-140, 1993

IS: ISSN
0733-9496

AB: Abstract
The use of geographic information systems (GIS) for spatial hydrologic data analysis has provided many benefits for water resources permitting and design. This paper discusses a computer

model, developed to aid phosphate mine-reclamation design, as an example of the means and real benefits to be derived by incorporating GIS into hydrologic modeling. The model integrates a commercial GIS, public-domain surface-water and ground-water hydrologic models, and a specially written evapotranspiration code to be run on a microcomputer within a highly structured interface. The user community consists of state and local regulatory agencies, mining companies, and private consultants. The GIS provides an important spatial/analytical function, performing the time-consuming georeferencing and spatial overlays (GIS modeling) to develop input data as well as providing a mechanism to link the surface-water and ground-water codes written with disparate spatial discretizations. This paper supports the premise that the incorporation of GIS into hydrologic modeling provides for an increased detail of evaluation, minimizes user subjectivity in parameter selection, and reduces costs of analysis due to significant time savings.

LA: Language
English

PY: Publication Year
1993

PT: Publication Type
Journal Article

DE: Descriptors
Surface waters; Mathematical models; Computer simulation; Phosphate mines; Land use; Land reclamation; Computer aided design; Evapotranspiration; Groundwater; Codes (symbols); Data reduction; Information retrieval systems

ID: Identifiers
Geographic information systems; Spatial hydrologic data analysis; Integrated hydrologic modeling

CL: Classification
EE 444.1 Surface Water; EE 921 APPLIED MATHEMATICS; EE 723.5 Computer Applications; EE 505.1 Nonmetallic Mines; EE 403.2 Regional Planning and Development; EE 444.2 Groundwater

SF: Subfile
Environmental Engineering Abstracts

AN: Accession Number
0042584

Record 113 of 145

TI: Title
Magnitude and variations of groundwater seepage along a Florida marine shoreline

AU: Author
Cable, JE; Burnett, WC; Chanton, JP

AF: Author Affiliation
Dep. Fish. and Aquatic Sci., 7922 NW 71 super(st) St., Univ. Florida, Gainesville, FL 32653, USA

SO: Source
Biogeochemistry, vol. 38, no. 2, pp. 189-205, Aug 1997

IS: ISSN
0168-2563

AB: Abstract
Direct groundwater inputs are receiving increasing attention as a potential source of nutrients and other dissolved constituents to

the coastal ocean. Seepage into St. George Sound, Florida was measured extensively from 1992 to 1994 using seepage meters. Spatial and temporal variations were documented along a 7-km stretch of coastline and up to 1 km from shore. Measurements were made at 3 transects perpendicular to shore and 1 transect parallel to shore. The general results indicated that seepage decreased with distance from shore (2 of 3 transects), and substantial temporal and spatial variability was observed in seepage flow from nearshore sediments. In addition, trends in mean monthly integrated seepage rates were similar to precipitation patterns measured at a nearby coastal weather station. Based on these measurements, we estimate that the magnitude of groundwater seepage into the study area is substantial, representing from 0.23 to 4.4 m super(3)/sec of flow through the sediments, approximately equivalent to a first magnitude spring. Although it is unknown how representative this region is with respect to global groundwater discharge, it demonstrates that groundwater flow can be as important as riverine and spring discharge in some cases. Our subsurface discharge rates suggest groundwater is an important hydrologic source term for this region and may be important to the coastal biogeochemistry as well.

LA: Language
English
SL: Summary Language
English
PY: Publication Year
1997
PD: Publication Date
19970800
PT: Publication Type
Journal Article
DE: Descriptors
USA, Florida, St. George Sound; Seepage; Shores; Sounds; Spatial Distribution; Temporal Distribution; Groundwater Movement; Groundwater Discharge; Surface-groundwater Relations; Coasts; Seepages; Ground water; Water budget; Beaches; Coastal zone; ASW, USA, Florida, St. George Sound
ER: Environmental Regime
Marine; Brackish; Freshwater
TR: ASFA Input Center Number
CS9902039
CL: Classification
SW 0840 Groundwater; SW 0810 General; Q2 02144 Regional studies, expeditions and data reports
UD: Update
199903
SF: Subfile
Water Resources Abstracts; ASFA 2: Ocean Technology Policy & Non-Living Resources
AN: Accession Number
4432565

Record 114 of 145

Record 115 of 145

TI: Title

Conceptualization and characterization of ground-water systems using geographic information systems

AU: Author
Kolm, Kenneth E

AF: Author Affiliation
Colorado Sch of Mines, Golden, CO, USA

CF: Conference
The 1994 International Symposium on Remote Sensing and GIS for Site Characterization, San Francisco, CA, USA, 01/27-28/94

SO: Source
ASTM SPEC TECH PUBL, ASTM, CONSHOHOCKEN, PA, (USA), 1996, no. 1279, pp. 131-145,

IS: ISSN
0066-0558

PB: Publisher
ASTM, CONSHOHOCKEN, PA, (USA)

AB: Abstract
The correlation and synthesis of a variety of two- and three-dimensional data is necessary to conceptualize and characterize ground-water flow systems in regional or site-specific areas. This paper presents an integrated, multidisciplinary, step-wise approach for conceptualizing, characterizing, and numerically simulating ground-water flow systems using Geographic Information Systems (GIS). The method presented involves seven iterative steps that can be accomplished manually or by using GIS: 1) Data gathering and preparation; 2) Field (on-site) conceptualization; 3) Surface characterization; 4) Subsurface characterization; 5) Hydrogeologic model characterization; 6) Hydrologic system characterization; and 7) Numerical model simulation. GIS may be used for: 1) data management, analysis, and visualization; 2) the integration of diverse data sources; 3) rapid development, visualization, and testing of alternative hydrogeologic and hydrologic system models; 4) the incorporation of contouring, attribute tables, and statistical analysis during data analysis and model development; and 5) the integration of basic and interpreted data bases with numerical modeling for purposes of model design, parameter discretization, statistical evaluation, and sensitivity analysis.

LA: Language
English

PY: Publication Year
1996

PT: Publication Type
Book Monograph; Conference

DE: Descriptors
Groundwater flow; Computer simulation; Data acquisition; Geologic models; Hydrology; Information management; Data reduction; Statistical methods; Database systems; Sensitivity analysis

ID: Identifiers
Conceptualization; Hydrogeologic model characterization

CL: Classification
EE 903.3 Information Retrieval and Use; EE 444.2 Groundwater; EE 723.5 Computer Applications; EE 723.2 Data Processing; EE 922.2 Mathematical Statistics; EE 723.3 Database Systems

SF: Subfile
Environmental Engineering Abstracts

AN: Accession Number

0221521

Record 116 of 145

TI: Title
Estimating groundwater recharge using an integrated surface and groundwater modelling approach
AU: Author
Chiew, FHS; McMahon, TA; O'Neill, IC
AF: Author Affiliation
Univ of Melbourne, Aust
SO: Source
J HYDROL, vol. 131, no. 1-4, pp. 151-186, 1992
IS: ISSN
0022-1694
AB: Abstract
This paper describes the use of an integrated surface and groundwater modelling approach to estimate regional groundwater recharge rates. The daily version of the Monash Rainfall-Runoff Model, HYDROLOG, was adapted to represent the surface hydrological processes and the finite-element groundwater model, AQUIFEM-N, used to model the groundwater flow. The integrated model was calibrated against streamflow and potentiometric head data, with recharge estimated as an output from the calibrated model. The model was applied to both the irrigated and non-irrigated areas in the northern half of the Campaspe River Basin in north-central Victoria, Australia. The integrated model utilises the important features of the surface and groundwater models. It is useful in evaluating water resource development through better management of the conjuctive use of surface and ground water, and is an important tool in any predictive recharge study.
LA: Language
English
PY: Publication Year
1992
PT: Publication Type
Journal Article
DE: Descriptors
Aquifers--Recharging; Hydrology--Australia; Mathematical Models; Rain and Rainfall; Runoff
ID: Identifiers
Groundwater Recharge; Monash Rainfall-Runoff Model HYDROLOG; Finite Element Groundwater Model AQUIFEM-N
CL: Classification
EE 444 Water Resources; EE 631 Fluid Flow; EE 471 Marine Science and Oceanography; EE 723 Computer Software, Data Handling and Applications; EE 443 Meteorology
SF: Subfile
Environmental Engineering Abstracts
AN: Accession Number
0125800

Record 120 of 145

TI: Title
Groundwater and Surface Water Interaction at Lake George, New South Wales

AU: Author
Jacobson, G; Jankowski, J; Abell, RS
AF: Author Affiliation
Groundwater Program, Bureau of Mineral Resources, GPO Box 378, Canberra ACT 2601, Australia
SO: Source
BMR Journal of Australian Geology & Geophysics BJAGDT, Vol. 12, No. 2, p 161-190, 1991. 30 fig, 4 tab, 39 ref.
AB: Abstract
Lake George is a fluctuating closed lake in the eastern highlands of Australia. A study of the hydrogeology of the lake basin was undertaken in an attempt to clarify the processes involved in the interaction of the groundwater and surface water systems. Groundwater in the catchment is mainly of low salinity, but high salinity groundwater is evident beneath the lake bed. Porewater analyses reveal a salinity profile in a clay aquitard beneath the lake bed that has the characteristics of diffusion but is also influenced by mixing with: (a) lake waters infiltrating downwards, and (b) groundwater rising upwards under pressure. Creek water and catchment groundwaters are fresh to brackish while lake water is alkaline. Varying ionic concentrations in these waters are the result of evaporative concentration and precipitation of carbonate minerals. Hydrochemical evolutionary pathways are different for groundwaters and surface waters. In surface waters, dolomite and calcite saturation is achieved early, but these waters are undersaturated with gypsum. In the groundwaters, saturation with dolomite and calcite is achieved early but equilibrium relationships are more complex. Shallow groundwaters show evidence of mixing with infiltrating lake waters, and this has retarded mineral precipitation. The deeper saline groundwaters are close to saturation with gypsum. Stable isotope data also indicate mixing occurring below the lake bed between evaporated lake waters infiltrating downwards and saline groundwaters under upwards pressure. (Author's abstract)
PY: Publication Year
1991
DE: Descriptors
*Australia; *Closed lakes; *Geochemistry; *Geohydrology; *Lakes; *New South Wales; *Surface-groundwater relations; *Water chemistry; Infiltration; Interstitial water; Mixing; Saline groundwater
CL: Classification
SW 0850 Lakes; SW 0840 Groundwater
SF: Subfile
Water Resources Abstracts
AN: Accession Number
9203972

Record 129 of 145

TI: Title
Coupled Three-Dimensional Ground-Water Flow and Lake-Stage Model of Northern Palm Beach County, Florida
AU: Author
Dacey, CA; Erickson, JR; Waddell, RK
AF: Author Affiliation
GeoTrans, Inc , Boulder, CO

SO: Source
Coastal Water Resources. Proceedings of a Symposium held in Wilmington, North Carolina. American Water Resources Association , Bethesda Maryland. 1988. p 411-417, 1 fig, 2 ref.

AB: Abstract
Increased groundwater withdrawals from the surficial aquifer in northern Palm Beach County, Florida have adversely impacted the lake stages of 21 shallow lakes in the Eastpointe Lake system. The interaction between the groundwater system and the lakes was evaluated by incorporating a nonlinear stage-volume relationship into the USGS 's flow code MODFLOW and using the modified 3-dimensional code to model the groundwater/surface water system. Effects of pumping and recharge stresses on lake stage, as well as effects of various well field pumpage scenarios and mitigative alternatives were evaluated. The active lake stage option was added to MODFLOW by deriving nonlinear stage-volume equations for the lakes. The resulting model was successfully calibrated to observation well data. Three major well fields were identified by the model as adversely impacting the Eastponte Lake system: the Hood, Jupiter and Mecca Farms well fields. Simulations with projected increased pumpages indicated that lake stages would be adversely affected without the implementation of mitigative measures. (See also W90-10584) (Lantz-PTT)

PY: Publication Year
1988

DE: Descriptors
Coastal waters; Eastpointe Lake; Environmental effects; Groundwater management; Model studies; Surface-groundwater relations; Water level; Water resources development; Aquifers; Computer models; Florida; Groundwater mining; Groundwater movement; Lake stages; Shallow water; Well fields; Wells

CL: Classification
SW 0840 Groundwater; SW 0850 Lakes; SW 4070 Ecological impact of water development

SF: Subfile
Water Resources Abstracts

AN: Accession Number
9010616

Record 132 of 145

TI: Title
Application of SHE for irrigation-command-area studies in India.

AU: Author
Lohani, VK; Refsgaard, JC; Clausen, T; Erlich, M; Storm, B

AF: Author Affiliation
Nat. Inst. of Hydro., Roorkee, India

SO: Source
Journal of Irrigation and Drainage Engineering [J IRRIG DRAIN ENG.], vol. 119, no. 1, pp. 34-49, 1993

IS: ISSN
0733-9437

AB: Abstract
One of key topics in irrigation engineering today is water management in irrigated command areas. This paper presents application of a comprehensive modeling approach based on the Systeme Hydrologique Europeen (SHE), which allows an integrated

modeling of all the relevant processes - overland flow, unsaturated zone flow, interception or evapotranspiration, ground-water flow, and river-channel flow to irrigation studies - at different scales ranging from a small plot to an entire command. Results of modeling studies the Barna command area in Madhya Pradesh, central India, are presented. The SHE simulated the advancing front of soil moisture as surface irrigation originated from the head end of a field, resulting in a nonuniform water distribution along the field. Furthermore, the effect of a shortage of water supply at the tail end of an irrigation canal was simulated. The study was carried out within the framework of an Indo-European project cooperation resulting in the transfer of the SHE technology to the National Institute of Hydrology, Roorkee, India.

LA: Language
English
PY: Publication Year
1993
PT: Publication Type
Journal Article
DE: Descriptors
Mathematical models; Irrigation; Water piping systems; Evapotranspiration; Surface waters; Hydrology
ID: Identifiers
Integrated modeling; Overland flow; Interception
CL: Classification
EE 821.3 Agricultural Methods; EE 921.5 Optimization Techniques; EE 619.1 Pipe, Piping and Pipelines
SF: Subfile
Environmental Engineering Abstracts
AN: Accession Number
0039006

Record 137 of 145

TI: Title
Interaction between the Groundwater and Unsaturated Soil-Water Flow Regions
AU: Author
Youngs, EG
AF: Author Affiliation
Rothamsted Experimental Station
SO: Source
Appropriate Methodologies for Development and Management of Groundwater Resources in Developing Countries. Volume III. Proceedings of an International Workshop held February 23-March 4, 1989. A. A. Balkema, Rotterdam. 1989. p 139-154, 2 fig, 39 ref.
AB: Abstract
The application of the physics of water movement through soils provides a rational basis for the management and development of water resources. The physics of water movement in saturated and unsaturated soils is used as the basis of a rational approach to problems involving the interaction between the groundwater and unsaturated soil-water flow regions. Two applications were made using physical theory: (1) the effect of evaporation on water table levels in unconfined aquifers under artesian conditions was analyzed; and (2) the movement of water tables in low- lying

wetlands as a response to meteorological input was computed. The classical theory used is based on continuum physics embodied in Darcy 's law and Richards ' equation for flow through inert homogeneous porous materials. However, the classical theory is inadequate in many real situations when there is soil heterogeneity, when there is soil swelling and shrinking, and when there is soil aggregation. To apply the classical theory of soil-water movement, these complications need to be considered when making measurements of soil properties for predicting water flow in soils; measurements of hydraulic soil properties have to sample volumes larger than the soil 's representative elementary volume, which can be found only by repeated measurement on different-sized samples. The collection of good field data could remain a major problem in the understanding of the physics of water movement in both saturated and unsaturated soils. (See also W91-03178) (Fish-PTT)

PY: Publication Year
1989

DE: Descriptors
Groundwater movement Infiltration Recharge Soil water; Surface-groundwater relations Aeration zone Analytical methods; Darcys law Groundwater management Hydrologic models Model; studies Physical models Soil physical properties Water resources; development Water resources management Wetlands

CL: Classification
SW 0840 Groundwater; SW 0845 Water in soils

SF: Subfile
Water Resources Abstracts

AN: Accession Number
9103187

Record 140 of 145

TI: Title
Test Holes for Monitoring Surface-Water/Groundwater Relations in the Cottonwood Creek Area, Shasta and Tehama Counties, California, 1984-85

AU: Author
Johnson, MJ; Houston, ER; Neil, JM

AF: Author Affiliation
Geological Survey Sacramento, CA. Water Resources Div

SO: Source
Available from Books and Open File Report Section, USGS Box 25425, Denver, CO 80225; paper copy $5.00, microfiche $4.00. USGS Water-Resources Investigations Report 88-4090, March 1989. 20p, 11 fig, 8 tab, 8 ref.

AB: Abstract
Ten test holes were drilled to obtain hydrogeologic information for an investigation of stream-aquifer interaction near proposed damsites on Cottonwood Creek and South Fork Cottonwood Creek, California. At each site, one deep well was completed below the first confining clay encountered in the upper Tehama Formation to determine hydraulic gradients between water-bearing deposits in the Tehama Formation and overlying channel deposits. At three sites along Cottonwood Creek, two shallow wells were drilled at each site on a line perpendicular to the stream channel to determine if groundwater in channel deposits is moving toward or

away from the stream channel and to monitor water levels. Geophysical logs were correlated with lithologic logs compiled from analyses of drill cuttings to determine depths for setting well screens. After pumping to confirm hydraulic connection between each well and the Tehama Formation, water levels were monitored monthly from June 1984 to June 1985; at two sites, water levels were above the altitude of the stream channel bottom during all streamflow conditions. Tritium dating indicates two wells have water more than 100 years old; one well has either a mixture of old and new water or an intermediate-aged water. (USGS)

PY: Publication Year
1989

DE: Descriptors
Tracers; Surface-groundwater relations; Dam construction; Damsites; Cottonwood Creek; California; Water quality; Piezometers; Stable-isotope analysis; Tritium; Deuterium; Shasta County; Tehama County; Dutch Gulch; Olinda; Tehama Formation; Nomlaki Tuff

CL: Classification
SW 0840 Groundwater; SW 2040 Groundwater management; SW 6070 Materials

SF: Subfile
Water Resources Abstracts

AN: Accession Number
8910478

Record 141 of 145

TI: Title
Hydrologic Functions of Sub-Alpine Wetlands in Colorado

AU: Author
Sundeen, KD; Leaf, CF; Bostrom, GM

AF: Author Affiliation
Enartech, Inc , Glenwood Springs, CO

SO: Source
Wetlands: Concerns and Successes. Proceedings of a Symposium held September 17-22 1989, Tampa, Florida. American Water Resources Association, Bethesda, Maryland. 1989. p 401-413, 4 fig, 9 ref.

AB: Abstract
Wetland areas provide valuable ecological functions which vary from site to site but can include: water quality protection, flood control, groundwater recharge, and wildlife habitat and recreation. The majority of studies that have evaluated specific ecological functions of wetlands have been conducted in coastal areas. However, wetlands are also a significant concern in other geographic locations such as the Central Rocky Mountains. Detailed hydrologic studies were implemented in association with a proposed water diversion project in the sub-alpine zone of Colorado. Over 70 groundwater monitoring wells were operated within 5 bottom valley wetlands. Streamflow gaging above and below the study wetlands was also conducted, along with water quality monitoring of both surface and groundwater. Sub-alpine wetlands within the Cross Creek and Fall Creek watersheds do not substantially influence hydrologic conditions within the area. The wetlands occupy the valley bottoms, yet have little interaction with the mainstream channels of the two creeks. Wetland hydrology is primarily influenced by on-site snowmelt and precipitation, and by

subsurface and tributary flow routed to the wetlands from adjacent hill slopes. Surface and groundwater movement is predominantly from the wetlands to Cross Creek and Fall Creek. The wetlands do not appear to be significantly affecting chemical water quality of the Cross or Fall Creeks. The wetlands do not substantially attenuate flood events or contribute to significant groundwater discharge. The wetland areas are functioning as sediment deposition zones. Aggradation within the wetland areas limits the sediment supply available for transport, and results in reduced sediment concentrations downstream. This function is largely a result of on-site topography and geologic conditions, and would occur even if the sites were not occupied by wetland vegetation. (See also W90-10912) (Lantz-PTT)
PY: Publication Year
1989
DE: Descriptors
Colorado; Rocky Mountains; Surface-groundwater relations; Wetlands; Cross Creek; Fall Creek; Geohydrology; Groundwater movement; Precipitation; Snowmelt; Surface water; Water quality
CL: Classification
SW 0810 General; SW 0850 Lakes
SF: Subfile
Water Resources Abstracts
AN: Accession Number
9010950

Record 143 of 145

TI: Title
Estimating groundwater leakage rates for input into land and water management plans
AU: Author
Brodie, Ross S
AF: Author Affiliation
Australian Geological Survey Organisation, Canberra, Aust
CF: Conference
Water Down Under 1994 Conference. Part 2-B (of 3), Adelaide, Aust, 11/21-25/94
SO: Source
NATL CONF PUBL INST ENG AUST, IE AUST, CROWS NEST, NSW, (AUST), 1994, vol. 2(B), no. 94/14, pp. 589-594,
IS: ISSN
0313-6922
PB: Publisher
IE AUST, CROWS NEST, NSW, (AUST)
AB: Abstract
Land and water management strategies for water table control are being planned and implemented for irrigation areas. An understanding of the interaction between the Shepparton Formation watertable aquifer and the underlying Pliocene Sands aquifer is fundamental to the development of salinity control measures. By using existing borehole data and recent hydrogeological mapping with GIS tools, the rate and direction of regional groundwater leakage between the two aquifers was estimated. The leakage estimate was combined with watertable depths and aquifer salinity and yield information to locate potential pumping sites. By using the raster based functionality of GIS, regional leakage rates were

quantified in a timely and cost-effective manner. The results can be integrated with current investigations into appropriate salinity and watertable control measures within the irrigation district.

LA: Language
English

PY: Publication Year
1994

PT: Publication Type
Book Monograph; Conference

DE: Descriptors
Management; Surface waters; Water quality; Irrigation; Aquifers; Hydrology; Leakage (fluid); Rivers; Salinity measurement; Geographical regions; Estimation

ID: Identifiers
Water management; Land management; Watertables; Waterlogging; Land salinisation; Groundwater leakage; Vegetation; Salinity

CL: Classification
EE 444.2 Groundwater; EE 912.2 Management; EE 444.1 Surface Water; EE 445.2 Water Analysis; EE 821.3 Agricultural Methods

SF: Subfile
Environmental Engineering Abstracts

AN: Accession Number
0158078

Record 144 of 145

TI: Title
Digital Analysis of Water Movement, Water Quality and Land Use Effects in a Stream-Aquifer System

AU: Author
Vaccaro, JJ; Bolke, EL; Tracy, JV

AF: Author Affiliation
Geological Survey Tacoma, WA

SO: Source
Proceedings of NWWA Western Regional Conference on Ground Water Management. San Diego, California October 23-26, 1983. National Water Well Association. National Water Well Association, Worthington, OH. 1984. p 295-303, 8 fig, 3 tab, 3 ref.

AB: Abstract
The Spokane aquifer, situated in eastern Washington and northwestern Idaho, was designated a sole source aquifer by the EPA. A study was done to quantify the groundwater flow system, to evaluate the amount of selected chemical constituents entering the aquifer from the land surface, and to evaluate the movement of water between the aquifer and the Spokane and Little Spokane Rivers. A coupled fluid flow and mass transport model was constructed, calibrated and operated to estimate a volumetric flow and mass flux budget for the aquifer-river system, which included (1) mass flux of selected chemical constituents from major land surface activities, (2) stream-aquifer flux and mass flux at 233 locations along the Spokane and Little Spokane Rivers, and (3) the impact of domestic, septic waste disposal systems on the groundwater quality of the Spokane aquifer. The 233 locations represent river model node points where river stage, discharge and water quality are calculated. The error in simulated groundwater levels was estimated to be plus or minus 6 ft, and the error in

simulated discharges was within the accuracy of the observed values. The conservative ion, chloride, was used as the mass transport modeled species with an error of 14%. The time-averaged budgets computed by the model indicate that subsurface inflow to the aquifer from the boundaries is the dominant recharge mechanism, both chemically and hydrologically. The Little Spokane River and the western (downstream) boundary are approximately constant discharge components of the groundwater system for the period of study. The areas that receive the largest land surface loadings do not always correspond to the observed higher concentration fields. This phenomenon is due to the spatial variability of the discharge per unit aquifer width and of the transmissivity. It was estimated that the impact of septic waste disposal systems, represented by the chloride ion, was <1 mg/liter increase over 80% of the aquifer. The model is a reasonable tool for assessing management decisions that could affect water quality, before they are imposed. (See also W88-09240) (Cassar-PTT)

PY: Publication Year
1984

DE: Descriptors
Washington; Surface-groundwater relations; Computer models; Path of pollutants; Model studies; Land use; Conjunctive use; Groundwater movement; Recharge; Water quality; Rivers; Solute transport; Spokane River; Aquifers; Mass transport; Waste disposal; Chlorides; Septic tanks; Septic wastewater

CL: Classification
SW 0835 Streamflow and runoff; SW 0840 Groundwater; SW 2060 Effects on water of human nonwater activities

SF: Subfile
Water Resources Abstracts

AN: Accession Number
8809273

Record 145 of 145

TI: Title
Surface Water and Groundwater Model Developments at the Waterways Experiment Station

AU: Author
Holland, JP

SO: Source
In: Proceedings of the Federal Interagency Workshop on Hydrologic Modeling Demands for the 90's. US Geological Survey Water-Resources Investigations Report 93-4018, 1993. p 4-52 - 4-59, 6 ref.

AB: Abstract
The Waterways Experiment Station's (WES's) Hydraulics Laboratory (HL) has the primary responsibility for the development of riverine, reservoir, wetland, and estuarine hydrodynamic and hydraulic models within the U.S. Army Corps of Engineers. HL also manages WES's expanding role in groundwater modeling research and development. Two estuarine hydrodynamic models have been developed: RMA10-WES and CH3D-WES (Curvilinear Hydrodynamics in Three Dimensions). The RMA10-WES code is a Galerkin-based finite element program that simulates three-dimensional unsteady flows in estuaries and rivers. CH3D-WES is a time varying,

three-dimensional numerical hydrodynamic model that can be applied to rivers, estuaries and reservoirs. STREMR is an HL-developed, two-dimensional hydrodynamic model that generates discrete solutions of the incompressible Navier-Stokes equations for depth-averaged or width-averaged flow. MAC3D is a finite-volume computer code under development that extends the basic STREMR formulation to calculate three-dimensional, non-hydrostatic, incompressible flow on staggered Marker-and-cell grids. The applications for this model are fluid-structure interactions, strongly three-dimensional open-channel flows, and environmental fluid mechanics. The HIVEL2D model is being developed to simulate the flow conditions of high velocity channels. HL is contributing to the demonstration erosion control (DEC) project by developing a set of coupled numerical modeling and analysis tools. The modeling and analysis package features integration of geographic information systems with several hydrologic and sediment transport models. Initial development has begun on a groundwater modeling system for simulating groundwater flow, the transport/fate of subsurface contaminants, and the efficacy of remedial actions. (See also W94-01146) (Author's abstract) 35 002621008

PY: Publication Year
1993

DE: Descriptors
*Computer models; *Groundwater; *Hydrologic models; *Model studies; *Surface water; Erosion control; Estuaries; Geographic information systems; Hydrodynamics; Mathematical models; Open-channel flow; Pollutant transport; Sediment transport; Three-dimensional models; Unsteady flow

CL: Classification
SW 5080 Evaluation, processing and publication; SW 0835 Streamflow and runoff; SW 0840 Groundwater

SF: Subfile
Water Resources Abstracts

AN: Accession Number
9310822

Results from searching the Elesevier database using: aquifer and (stream or river or lake) and interaction.

May be duplicates with the above results.

100 Serrano Sergio E., Workman S.R., Modeling transient stream/aquifer interaction with the non-linear Boussinesq equation and its analytical solution, Journal Of Hydrology (206)3-4 (1998) pp. 245-255

97 Workman S.R., Serrano S.E., Liberty K., Development and application of an analytical model of stream/aquifer interaction, J. Hydrology (200)1-4 (1997) pp. 149-163

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79 Choi J., Hulseapple S.M., Conklin M.H., Harvey J.W., Modeling CO2 degassing and pH in a stream--aquifer system, Journal Of Hydrology (209)1-4 (1998) pp. 297-310

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S.R., Perkins S.P., Integrated numerical modeling for basin-wide water management: The case of the Rattlesnake Creek basin in south-central Kansas, Journal Of Hydrology (214)1-4

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73 Refsgaard J.C., Thorsen M., Jensen J.B., Kleeschulte S., Hansen S., Large scale modelling of groundwater contamination from nitrate leaching, Journal Of Hydrology (221)3-4 (1999) pp. 117-140

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69 Criss R.E., Davisson M.L., Isotopic imaging of surface water/groundwater interactions, Sacramento Valley, California , J. Hydrology (178)1-4 (1996) pp. 205-222

69 Lyons W.B., Tyler S.W., Gaudette H.E., Long D.T., The use of strontium isotopes in determining groundwater mixing and brine fingering in a playa spring zone, Lake Tyrrell, Australia, J. Hydrology (167)1-4 (1995) pp. 225-239

68 Njitchoua R., Dever L., Fontes J.Ch., Naah E., Geochemistry, origin and recharge mechanisms of groundwaters from the Garoua sandstone aquifer, northern Cameroon, J. Hydrology (190)1-2 (1997) pp. 123-140

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100 Devito K.J., Hill A.R., Roulet N., Groundwater--surface water interactions in headwater forested wetlands of the Canadian Shield, J. Hydrology (181)1-4 (1996) pp. 127-147

97 Criss R.E., Davisson M.L., Isotopic imaging of surface water/groundwater interactions, Sacramento Valley, California , J. Hydrology (178)1-4 (1996) pp. 205-222

92 Gerke Horst H., Molson John W., Frind Emil O., Modelling the effect of chemical heterogeneity on acidification and solute leaching in overburden mine spoils, Journal Of Hydrology (209)1-4 (1998) pp. 166-185

89 Cey Edwin E., Rudolph David L., Parkin Gary W., Aravena Ramon, Quantifying groundwater discharge to a small perennial stream in southern Ontario, Canada, J. Hydrology (210)1-4 (1998) pp. 21-37

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80 Nativ Ronit, Adar Eilon, Dahan Ofer, Nissim Ilan, Water salinization in arid regions---observations from the Negev desert, Israel, Journal Of Hydrology (196)1-4 (1997) pp. 271-296

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75 Becker Alfred, Braun Peter, Disaggregation, aggregation and spatial scaling in hydrological modelling, Journal Of Hydrology (217)3-4 (1999) pp. 239-252

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Ruan H., Illangasekare T.H., A model to couple overland flow and infiltration into macroporous vadose zone, J. Hydrology (210)1-4 (1998) pp. 116-127

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98 de Vries J.J., Seasonal expansion and contraction of stream networks in shallow groundwater systems, J. Hydrology (170)1-4 (1995) pp. 15-26

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DATABASE: Geobase
SEARCH STRING: su:(integrated surface ground water) or ab:(integrated surface ground water) or ab:(interaction surface ground water)

Record: 16
NUMBER: 92J-10231
AUTHOR: Chiew, F. H. S.; McMahon, T. A.; O'Neill, I. C.
AFFILIATION: Dept. Civil & Agricultural Eng., Univ. of Melbourne, Vic., Australia
TITLE: Estimating groundwater recharge using an integrated surface and groundwater modelling approach
JOURNAL: Journal of Hydrology, v131 n1-4, pp 151-186
YEAR: 1992
LANGUAGE: English
ABSTRACT: The daily version of the Monash Rainfall-Runoff Model, HYDROLOG, was adapted to represent the surface hydrological processes and the finite-element groundwater model, AQUIFEM-N,

used to model the groundwater flow. The integrated model was calibrated against streamflow and potentiometric head data, with recharge estimated as an output from the calibrated model. The model was applied to both the irrigated and non-irrigated areas in the northern half of the Campaspe River Basin in north-central Victoria, Australia. The integrated model utilises the important features of the surface and groundwater models. It is useful in evaluating water resource development through better management of the conjunctive use of surface and ground water, and is an important tool in any predictive recharge study. -from Authors
DESCRIPTORS: salinity control; HYDROLOG; groundwater recharge; integrated surface and groundwater model; recharge rate; irrigated agriculture; water table level; AQUIFEM N; Australia; Victoria; Campaspe River Basin
SUBJECT CODE: Geography

Record: 17
NUMBER: 92J-06832
AUTHOR: DeCoursey, D. G.
AFFILIATION: USDA-ARS, Hydro-Ecosystem, 243 Federal Building, 301 South Howes, PO Box E, Fort Collins, CO 80522, USA
TITLE: Integrated quantity/quality modeling - receiving waters
MONOGRAPH: in: Recent advances in the modeling of hydrologic systems, pp 323-353
EDITOR: Bowles, D.S.; O'Connell, P.E.
PUBLISHER: (Kluwer; NATO ASI Series C, 345)
YEAR: 1991
LANGUAGE: English
ABSTRACT: Nonpoint sources of pollution have become significant problems, emphasized by the fact that nitrates and pesticides are being increasingly discovered in ground and surface water supplies. This chapter describes the use of mathematical models used to simulate the movement of water and chemicals in receiving waters: ground water, surface runoff, and surface impoundments. -from Author
DESCRIPTORS: nonpoint source pollution; groundwater quality; runoff water quality; water quality modelling
SUBJECT CODE: Geography

DATABASE: Geobase
SEARCH STRING: su:(surface and ground and water and (interaction or integrated))
Record: 61
NUMBER: 88B-2091
AUTHOR: PINKER, R. T.; CORIO, L. A.
AFFILIATION: -Martin Marietta Env Systems, Columbia, MD 21045, USA
TITLE: Estimating monthly mean water and energy budgets over the Central US Great Plains. Part I: evapoclimatonomy model formulation
JOURNAL: Monthly Weather Review, v115 n6, pp 1140-1152
YEAR: 1987
LANGUAGE: English
ABSTRACT: A modified form of Lettau's evapoclimatonomy model is used to calculate the model response functions for runoff, soil moisture, change of soil moisture with time, and evapotranspiration. The objectives are 1) to implement and test the model on spatial and temporal scales for which it was

originally designed; 2) to test the validity of the model on reduced scales (Part II). If the evapoclimatonomy approach is applicable on shorter time scales, the model output of monthly mean evapotranspiration can be used as independent 'ground truth' for testing current point parameterizations to calculate the surface energy and water budgets. This is presently of particular interest since some of the input parameters can be derived from spatially integrated satellite observations. -from Authors
SUBJECT CODE: Geography

DATABASE: Geobase
SEARCH STRING: su:(surface and ground and water and (interaction or integrated))

Record: 32
NUMBER: 92J-10231
AUTHOR: Chiew, F. H. S.; McMahon, T. A.; O'Neill, I. C.
AFFILIATION: Dept. Civil & Agricultural Eng., Univ. of Melbourne, Vic., Australia
TITLE: Estimating groundwater recharge using an integrated surface and groundwater modelling approach
JOURNAL: Journal of Hydrology, v131 n1-4, pp 151-186
YEAR: 1992
LANGUAGE: English
ABSTRACT: The daily version of the Monash Rainfall-Runoff Model, HYDROLOG, was adapted to represent the surface hydrological processes and the finite-element groundwater model, AQUIFEM-N, used to model the groundwater flow. The integrated model was calibrated against streamflow and potentiometric head data, with recharge estimated as an output from the calibrated model. The model was applied to both the irrigated and non-irrigated areas in the northern half of the Campaspe River Basin in north-central Victoria, Australia. The integrated model utilises the important features of the surface and groundwater models. It is useful in evaluating water resource development through better management of the conjunctive use of surface and ground water, and is an important tool in any predictive recharge study. -from Authors
DESCRIPTORS: salinity control; HYDROLOG; groundwater recharge; integrated surface and groundwater model; recharge rate; irrigated agriculture; water table level; AQUIFEM N; Australia; Victoria; Campaspe River Basin
SUBJECT CODE: Geography

Record: 39
NUMBER: 91J-07487
AUTHOR: Shaw, R. D.; Prepas, E. E.
AFFILIATION: Dept Zoology and Meanook Biol. Res. Station, Univ. Alberta, Edmonton, Alta T6G 2E9, Canada
TITLE: Groundwater-lake interactions: II. Nearshore seepage patterns and the contribution of ground water to lakes in central Alberta
JOURNAL: Journal of Hydrology, v119 n1-4, pp 121-136
YEAR: 1990
LANGUAGE: English
ABSTRACT: Seepage flux into the lakes ranged from 3 X 10 "SUP -10" to 2 X 10 "SUP -7" ms "SUP -1" . Seepage out of the lakes was

recorded at only one of 92 seepage meter sites. At one lake, seepage was measured fortnightly along transects at two locations, from May to August 1986; seepage patterns were consistent throughout that period. In the nearshore region of six of 10 lakes, seepage flux to the lakes decreased with distance from shore. Deviations from that pattern were probably a result of: (1) spatial variability of seepage flux within a small area of lakebed; (2) intertill sand and gravel lenses near the lake (3) preglacial bedrock channels of sand and gravel underlying some of the lakes. Groundwater was the major source of water (49% of total inflow) to one lake; at the other lakes, groundwater was a relatively small component (10%) of total inflow. -from Authors
DESCRIPTORS: seepage pattern; nearshore seepage; seepage flux; surface water groundwater interaction; Canada; Alberta
SUBJECT CODE: Geography

Record: 40
NUMBER: 91J-07442
AUTHOR: Roulet, N. T.
AFFILIATION: Dept Geog., York Univ., 4700 Keele St., North York, Ont., Canada M3J 1P3
TITLE: Hydrology of a headwater basin wetland: groundwater discharge and wetland maintenance
JOURNAL: Hydrological Processes, v4 n4, pp 387-400
YEAR: 1990
LANGUAGE: English
ABSTRACT: Groundwater of local and regional origin passes through the swamp by two routes: surface streamlets, where groundwater that emerges at specific seepage points in the swamp is conveyed over the ground surface with little interaction with the swamp itself, and by diffuse seepage in the swamp and through the bed of the stream. While the diffuse seepage is the smaller component of groundwater it maintains the swamp's saturation. Groundwater input to the swamp from the specific seepage points and diffuse flow varies little over a year therefore the saturation of the swamp and baseflow from the basin display little seasonal variation compared to other wetland types. The existence of the valley bottom in the headwater basin alters the seasonal and storm hydrology and is important to biogeochemical transformation of emerging groundwater. -from Author
DESCRIPTORS: surface water groundwater interaction; groundwater discharge; wetland maintenance; spring fed swamp; base flow; seepage; Canada; Ontario
SUBJECT CODE: Geography

Record: 45
NUMBER: 90J-09037
AUTHOR: Abdul, A. S.; Gillham, R. W.
AFFILIATION: Env Sci Dept, General Motors Res Lab, Warren, MI 48090, USA
TITLE: Field studies of the effects of the capillary fringe on streamflow generation
JOURNAL: Journal of Hydrology, v112 n1-2, pp 1-18
YEAR: 1989
LANGUAGE: English
ABSTRACT: Two field experiments were conducted to investigate the effect

of the capillary fringe on surface water-groundwater interactions and on streamflow generation in a shallow water-table aquifer. The results from both experiments showed that the water-table adjacent to the stream, where the capillary fringe extended to or close to ground surface, responded rapidly to the precipitation events due to the initially low storage capacity of the medium. This rapid and large response led to the development of a water-table mound on both sides of the stream and flow nets showed that the mound resulted in the discharge of pre-event water through the seepage faces that developed on both sides of the stream. Furthermore, the mound contributed to the discharge of event water in that precipitation falling on the seepage faces was transported directly to the stream as overland flow. -from Authors
DESCRIPTORS: capillary fringe; streamflow generation; surace water groundwater interaction; overland flow; subsurface flow; hydrograph separation
SUBJECT CODE: Geography

Record: 46
NUMBER: 90J-04845
AUTHOR: Ryan, K. W.
AFFILIATION: Storch Engineers, Florham Park, NJ, USA
TITLE: Two-dimensional numerical simulation of the relationship between sinkhole lakes and ground water along the central Florida ridge
MONOGRAPH: in: Engineering and environmental impacts of sinkholes and karst. Proc. 3rd conference, St. Petersburg Beach, FL, 1989, pp 33-45
EDITOR: Beck, B.F.
PUBLISHER: (Balkema)
YEAR: 1989
LANGUAGE: English
ABSTRACT: An observation well network has been installed around a small lake in central Florida to investigate whether 'plugged' sinkholes provide an avenue for contamination to reach potable water supplies in the Floridan Aquifer. Regional and site-specific numerical simulations indicate that leakance from lakes to the Floridan Aquifer occurs under the majority of geologic settings typical of the study area, regardless of the presence or absence of fractures and other high permeability conduits associated with solution or subsisdence features. In particular, leakance through the lake bottom can be expected to occur where: the anisotropy ratio (Kh/Kv) = or <100, the hydraulic gradient = or <0.02, or a water table mound is absent on the regional downgradient side of the lake. -from Author
DESCRIPTORS: surface water groundwater interaction; groundwater contamination; potable water quality; sinkhole lake; USA; Florida; Florida Aquifer
SUBJECT CODE: Geography

Record: 51
NUMBER: 89J-02787
AUTHOR: Siegel, D. I.
AFFILIATION: Dept of Geol, Syracuse Univ, Syracuse, NY 13244-1070, USA
TITLE: The recharge-discharge function of wetlands near Juneau,

Alaska: part I. Hydrogeological investigations
JOURNAL: Ground Water, v26 n4, pp 427-434
YEAR: 1988
LANGUAGE: English
ABSTRACT: Water levels in piezometers and the hydraulic conductivity of soils were measured during spring and summer 1986 to evalute the recharge-discharge function of wetlands in the Mendenhall Valley. Computer modeling experiments evaluated the function of a large patterned fen. The blanket bogs are probably

Record: 53
NUMBER: 89J-03784
AUTHOR: Prince, K. R.; Franke, O. L.; Reilly, T. E.
TITLE: Quantitative assessment of the shallow ground-water flow system associated with Connetquot Brook, Long Island, New York
JOURNAL: US Geological Survey Water-Supply Paper, v2309, 28 pp
YEAR: 1988
LANGUAGE: English
ABSTRACT: Streamflow on Long Island is derived principally from shallow ground water that flows above the deeper regional flow system. The movement of shallow ground water was studied during 1975-82 at Connetquot Brook, an undisturbed stream in Connetquot River State Park, in south-central Long Island, New York. The investigation encompassed 1) field studies of streamflow, ground-water levels, and age of water as indicated by tritium and dissolved-oxygen concentrations and 2) numerical simulation of the shallow flow system to evaluate the hydraulic factors that govern the direction of shallow ground-water flow near and beneath the stream. -from Authors
DESCRIPTORS: quantitative assessment; shallow ground water flow system; groundwater discharge; surface water/groundwater interaction; USA; New York; Long Island; Connetquot Brook
SUBJECT CODE: Geography

Record: 57
NUMBER: 88B-1790
AUTHOR: VASILIEV, O. F.
AFFILIATION: Lavrentyuv Inst of Hydrodynamics, Novosibirsk 630090, USSR.
TITLE: System modelling of the interaction between surface and ground waters in problems of hydrology.
JOURNAL: Hydrological Sciences Journal/Journal des Sciences Hydrologiques, v32 n3, pp 297-311.
YEAR: 1987
LANGUAGE: English
ABSTRACT: Surveys mathematical modelling of the interaction between surface water and groundwater. The construction of such coupled models requires the development of methods of conjunction between models which represent surface and subsurface flows. The characteristic time-scales of transient processes for surface water and groundwater differ greatly, and this is of profound importance in the numerical modelling of their interconnected motion.-from Author
SUBJECT CODE: Geography